The Australian Accountant

Published monthly for the Commonwealth Institute of Accountants, The Australasian Institute of Cost Accountants, and the New Zealand Institute of Cost Accountants (Incorporated)

Vol. XXI, No. 4 APRIL, 1951 Subscription: Per annum, 15/- Single copies, 2/-

A DISSERTATION UPON ROAST PIG AND BREAK-EVEN ANALYSIS

by

A. FORSTER, A.I.C.A.

Oliver Heaviside once observed that the prevalent idea of mathematical works is that you must understand the reason why first, before you proceed to practice. That (he said) is fudge and fiddlesticks.

It is proper, of course, that there should be, in relation to break-even analysis, someone with a more literal turn of mind in the field of applied mathematics to act, as it were, as devil's advocate against the admission of this new knowledge, although much of the criticism launched against it may be described, not unfairly, as "fudge and fiddlesticks."

In the field of applied mathematics, experimentation goes on and solutions are obtained to problems without the "why" being fully understood. At a later stage the "pure" mathematician comes along and tidies things up with logic, rigour, and beta functions.

Since this is an account of developments in the application of the technique of break-even analysis — and also about a swineherd, Ho-ti, his eldest son Bo-bo, and the symbol "i"—readers will, of course, carefully distinguish it from anything like, for example, the doctoral dissertation of Dr. John Gaillard, lecturer in the Department of Industrial Engineering at Columbia University, on the progress-time curve. However, I would hasten to add that Dr. Gaillard's paper may be recommended for serious reading. I must leave you to find out for yourself whether the same applies to the contents of this paper.

The Symbol "i"

Casting around for illustrative ideas prompted the recollection of the little eccentricity which the author of "Nature Boy" is noted for, namely that he uses lower-case exclusively and signs himself "eden ahbez." There was another character—whose modesty, however, successfully eliminated his name from the history of those times—who, in or about 1572, experimented with the symbol " i." Strange things happened. He noticed from time to time that his work could be much shortened and the correct answer obtained if, in the middle of his working, he used the sign " i," assumed i^2 to be —1, and in all other respects treated "i" just as if it were an ordinary number. Now he was very doubtful about his method, and the people who followed him and adopted the symbol "i" were doubtful of it too, but it kept on giving the correct answers although none then knew why it should. For two centuries mathematicians used it without any justification other than success. It was not until about 1800 that a logical explanation of the meaning of "i" was given. We should be most grateful that the mathematicians continued to use it, for it proved most useful in the design of dynamos, electric motors, electric lighting, wireless apparatus, and in the development of the theory of flight.

We should not expect quite such startling developments to flow from the application of break-even analysis, but, nevertheless, the technique has proved extremely

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useful as providing a new dimension and the necessary perspective for management, which has the task of trying to understand our reports on the state of a business as enshrined in the balance sheet and the profit and loss statement.

Genoa, 1327; London, 1827

It is true that George Jackson, accountant, could write in 1827 that "... the system of book-keeping by double-entry is one of consummate beauty ..." and have a fair chance of being believed, for his work ran into some twenty-odd editions. There are others who say it was invented by the Genoese bankers about 1327 to confound the merchants, and that it has successfully done so ever since. In George Jackson's day a statement of the "stock" account or balance account foreshadowed the form of the present-day balance "sheet" and the use of narration to make its meaning clear. He concludes, for example:

"Thus it appears that John Tomkins, on 1st Jan., 1824, owed ..	£1,250
"And that there is owing to him ..	£1,750
"And that his Net Stock is	£500

"which will be quickly comprehended if instead of 'Stock' we say the Concern, or the name of its proprietor...."

In the course of many attempts at simplified graphic portrayal of the conventional tabular statements the relation of expenses to sales was examined functionally instead of in time perspective. This method of analysis led to the profit and loss chart and the break-even chart* once it was found that the form of the secular trends in expenses and in sales were similar. This is an example of the empirical method.

Crackling!

Empiricism at its lowest level is immortalised by Charles Lamb in his "Essay on Roast Pig," in which he tells the story of a swineherd, Ho-ti, who left his cottage in the care of his eldest son, Bo-bo, who, being fond of playing with fire, ended by reducing the cottage to ashes. "Together with the cottage ... what was of much more importance, a fine litter of new farrowed pigs, no less than nine in number, perished. Bo-bo was in utmost consternation...." While he was thinking what he should say to his father an odour assailed his nostrils. A premonitory moistening at the same time overflowed his nether lip. He stooped down to feel if there were any signs of life in the pig. He burnt his fingers, and to cool them he applied them in his booby fashion to his mouth. Some of the crumbs of the scorched skin had come away with his fingers, and for the first time in his life (in the world's life, indeed, for before him no man had known it) he tasted—crackling! It is said that later, after the secret had been dragged into the light in a law court, "there was nothing to be seen but fires in every direction." It was, of course, wasteful for the compatriots of Ho-ti to burn their houses in order to roast pig. It is desirable to discover the causes of an observed phenomenon so that the essential factors can be reproduced in the most advantageous way and applied generally. As George Jackson, accountant, would say, the lessons to be derived from the application of the empirical method may be "quickly comprehended."

C. E. KNOEPPEL'S WORK[1]

When the first "cross-over" chart was drawn to illustrate the basic idea of break-even analysis, the knowledge which formed the basis for the first working hypothesis was limited to the painstaking observations of one man in relation to a set of facts derived from one firm's transactions.

For something like 20 years the patient collection of facts went on, there was speculation as to the meaning of the re-

* As devised by Walter Rautenstrauch.

[1] C. E. Knoeppel.—*Profit Engineering*, 1933, is only one of the works of this writer; others include: *Maximum Production in Shop and Foundry, Organisation and Administration, Installing Efficiency Methods, Graphic Production Control, Industrial Preparedness*, and *Managing for Profit* (in conjunction with Seybold). He wrote *Profit Engineering* against a background of some 28 years' professional experience as a consulting industrial engineer, was at one time an associate of Harrington Emerson. At the time of writing *Profit Engineering* he was* a member of the American Society of Mechanical Engineers; a member and National Director, Society of Industrial Engineers; and a member, National Association of Cost Accountants. The section "Mathematics Behind the Profitgraph" was written by Arthur J. Minor, B.S., C.E., consulting engineer.

* C. E. Knoeppel died in 1936.

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sults, and the tentative theory which had been developed was modified and a body of mathematics expressing that theory was brought together. New experience was gained—again the theories were put to the test. Experimental test alternated with theoretical speculation; practical applications with intensive research.

Apart from Knoeppel's work, which he brought up to date in 1933, the major developments in the theory and practice of break-even analysis have taken place in the 16-year period since 1934.

Knoeppel Uses Cross-over Chart

It was in 1904 that Henry Hess (of ball-bearing fame) made an analysis of wage-payment methods from the points of view of the employee, the employer, and invested capital, and illustrated the results of this study with a number of charts, including a cross-over chart with an expense line commencing at zero. This work was published in *The Engineering Magazine* (issues of April, May, and June of 1904) and came to the attention of C. E. Knoeppel. Knoeppel recalled this method of charting when he was faced with a problem in his practice some five years later, involving the determination of "normal" capacity as a basis for the standardisation of overhead costs and the adjustment of over- or under-applied expense, and the determination of "maximum" capacity and the relation of a past period of years' average to it. In resolving this problem, Knoeppel states, he developed, in 1909, "a rather crude cross-over chart," which is reproduced in *Graphic Production Control*. at p. 378, the accompanying text reading. ". . . There are naturally some costs which must be met whether there is any work done or not. In other words, cost does not begin at zero, but at a point which represents fixed expenses whether the plant operates or not. When goods are being produced, costs are plotted from this point. By plotting sales from zero, the cost and sales lines will cross at some point, to the left of which there will be losses, and to the right, profits. By plotting actual figures and capacity against these lines some valuable information can be secured."

The Profitgraph

In the intervening years between 1909 and 1933, Knoeppel developed and applied this method of presenting graphically a volume costs and profits relationship in the form of a chart as a presentation device. This device became known generally as a "profitgraph" for the reason that Knoeppel intended that it should be used to illustrate the salient features of profit-planning which, in essence, meant the application of graphic methods to a budgeting technique. The aim was to show an income statement, both actual and budget, for various income levels—a variable income statement for a relatively short period. He states: ". . . the Profitgraph is essentially a graphic master budget (a variable budget) for a year or shorter period with each 1 per cent. of capacity having its own particular budget . . . a . . . 'fixed' budget (as illustrated) and as such it . . . represents a goal and a target . . . but . . . to work without adjusting this budget to meet changing conditions is fallacious. . . ."

The Break-even Point

Arthur J. Minor, B.S., C.E., working with Knoeppel's principle of variable budgeting, with which the profitgraph was associated, developed a body of mathematical formulae underlying the application of the technique. This material is included in Knoeppel's *Profit Engineering*, 1933 (1st ed.).

That short-range estimating or budgeting, within existing practical capacity, was intended to be a basic feature of that technique is evidenced by the first-stated formula for the determination of the profitless (or break-even) point. It is stated in this way:

(a) To determine operating profitless point (in £'s) when total net sales income, total fixed outgo, and total variable outgo, all at 100 per cent. capacity, are known—

$$X_{op} = \frac{F}{1 - \frac{V}{S}}$$

with X_{op} representing the required break-even point, F fixed outgo, V variable outgo, and S net sales income.

(b) When there is a surplus of net sales income on total costs, F and V become—

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$$F = F_{op} - F_o$$
$$V = V_{op} - V_o$$

in solving for X (in £'s), with F_{op} and V_{op} denoting fixed and variable costs.

(c) When there is an excess of total costs over net sales income, the F_o and V_o values become plus values.

A linear cost function is assumed, and the curve used is a ("straight line") first degree curve of the type $Y = mx + b$ or $Yc = a + bX$.[2]

Knoeppel's text does not assume an unlimited market in relation to volume of sales, and not only cautions against unreal projections but also indicates some of the steps which should be taken before budgeting sales volume.

Knoeppel has also recast the "layout" of his chart so that, for some purposes, the variable expense area is placed at the base of the chart, where fixed expense had been shown previously. In the illustration forming the frontispiece to his 1933 text, he builds up from the base the cost to manufacture and sell on the elements of direct costs of material and labour, then overhead ("variable") and overhead ("fixed"), in that order, with a break-down of the profit function, as a residual, into its budgeted components, including income tax, dividends, and other surplus.

Knoeppel also wrote a further work (in conjunction with Seybold), *Managing for Profit*.

Behind the Lines

According to E. Dillon Smith[3], three different procedures are possible in applying the "method of least squares". These actually represent two extremes and the mean. The first is the condition that makes the sum of the residuals least for X on Y; the second that makes the normal form the (X, Y)'s the least; and the third that makes the sum of the residuals least for Y on X.

Professor Theodore H. Brown[4] (Professor of Statistics at the Harvard Graduate School of Business Administration), amplifies the observations of Dillon Smith, pointing out that there are not only three, but actually an infinite number of different solutions are possible under the method of least squares.

The equations usually given in textbooks tacitly make the assumption that the deviation should be drawn parallel to the Y or vertical axis. For this purpose the equation of the straight line is $y = a + bx$, where a and b are the constants determined from the data. If it is desired to measure the deviation parallel with the X axis, one starts with the equation $X = A + BY$, where A and B are the constants determined by the data and where these values are not necessarily the same as those for a and b. These two methods of drawing the deviation are the extremes for a given problem. In fact the deviation can be drawn at any other constant angle which the investigator may desire to use. For each of the ways of drawing the deviation there is usually found a different line. The result is that the two lines used to determine a break-even point may not always intersect at precisely the same point.

Significance of 45° Angle

The decision made regarding the way in which the deviations are drawn has a simple meaning. When the deviations are drawn parallel to the Y axis the assumption is that the X values are absolutely accurate relative to the Y values. The converse is true when the deviations are drawn parallel to the X axis. Drawing the deviations at an angle of 45° is equivalent to the assumption that X and Y values are equally likely to error. There is still another possibility which will cause the intersection representing the break-even point to vary within an appreciable area. This arises from the fact that the data to which a line is fitted are experimental in character. They contain commonly the effect of many factors which

[2] The "method of least squares" for the fitting of such a straight line is explained at pp. 65-66 of *Statistical Methods as Applied to Accounting Reports*, A. A. Fitzgerald, 1941 (Accountants Publishing Co.). For a more extensive treatment, see *Applied General Statistics*, Croxton and Cowden (Sir Isaac Pitman & Sons); *Business Statistics*, Riggleman and Frisbee, 1938 (McGraw Hill Book Co.); *Statistical Procedures and their Mathematical Bases*, Peters and Van Voorhis, 1940 (McGraw Hill Book Co.).

[3] *Mechanical Engineering*, vol. 55, No. 8, August 1933.

[4] Quoted by Roy A. Foulkes, *Practical Financial Statement Analysis*, 1950, at p. 538.

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cause the fitted line to depart from a position which it would occupy if such additional factors were not operating. The consequence of this principle is that the line finally fitted to a set of data should be considered as a centre of an experimental band of possibilities within which the true position of the line would be located if all figures could be evaluated. The result of this principle for two lines is that there is a parallelogram formed by the boundaries of the two intersecting bands. Within this area the true intersection would be definitely known if all unwanted influences were precisely accounted for.

DEVELOPMENTS BY WALTER RAUTENSTRAUCH[5] AND RAYMOND VILLERS[6]

It is claimed that break-even analysis and the "break-even chart"—as distinct, perhaps, from Knoeppel's profitgraph—was originated by Rautenstrauch. The *New York Times* of 3rd October, 1948, for example, refers to "... the 'break-even chart', which is the invention of Dr. Walter Rautenstrauch of Columbia University..." and a footnote to p. 80 of his latest work (in conjunction with Raymond Villers), *The Economics of Industrial Management*, 1949, states that "This method of analysis, resulting in the Profit and Loss Chart and the Break-even Chart, was devised by Rautenstrauch more than 30 years ago." i.e., about 1919.

Rautenstrauch refers to his method of break-even analysis, and supplies details of a number of analyses, in his *Industrial Surveys and Reports*, 1940. He developed it still further in a work, published in the following year, *The Design of Manufacturing Enterprises*, but it is to his latest work that we should look for up-to-date information, for during the intervening years important definitive work by others at Columbia University, notably that of Professor Joel Dean, has supplemented his own further research, and his present work was, as noted, done in conjunction with Raymond Villers.

The Profit and Loss Chart

Rautenstrauch and Villers point out, after examining a tabular profit and loss statement in comparative form[7], that the data does not indicate much more than the fact that such items as net sales, expenses, and profits have increased during the years. They go on to plot secular trend lines (or basic or long-time trend lines) for cost of goods sold and sales, and conclude that there is some functional or dependent relationship between expenses and sales. They then plot labour cost, material cost, and total cost-of-goods-sold, against sales volume, and find that each of these falls along a straight line of central tendency. They then test this hypothesis against further actual results shown by individual companies—the United States Steel Corporation, General Electric Company, Pet Milk Company, Allis Chalmers Company, National Lead Company, Dow Chemical Company, Monsanto Chemical Company and subsidiaries, Lehigh Portland Cement Company, Equitable Office Building Corporation, Montgomery Ward and Company, and General Motors Corporation—and whole industries—mining, contract construction, manufacturing, and electric utility industries—to find, throughout, the same consistent straight-line trend in sales and in expenses.

Rautenstrauch and Villers draw a line-of-trend for sales on the same chart as they have plotted the total expense trend, so that the chart portrays profit or loss as well as expenses and sales, whence the name

[5] Dr. Walter Rautenstrauch has been for many years on the staff of Columbia University; he is now Professor Emeritus of Industrial Engineering. He has had extensive experience in industry, and has served as a president, vice-president, and treasurer of a number of companies. He is author of nine books in the field of engineering, and the originator of the profit and loss chart and the break-even chart. He is now associated in industrial consulting practice with Dr. Raymond Villers. [*Time*, issue of 15 January, 1951, carries a report of the death of Walter Rautenstrauch (70).]

[6] Dr. Raymond Villers, a graduate of the Sorbonne in Paris, was born in France and received degrees from several universities, including Columbia University, where he is now Assistant Professor of Industrial Engineering. After he held responsible positions in industry and government service and served in the U.S. Navy during the last war, he received in 1946 the Du Pont de Nemours-General Motors Joint Fellowship of Research.

[7] Comparative financial statements, 1941-1945, for the beverage industry for 74 identical manufacturers in the $250,000-$1,000,000 assets group.

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"profit and loss chart." They are dealing with an historical record of data relating to these items (uncorrected).

They conclude that the regularity in the sales and expense relationships observed suggests that expense is functionally related to sales and that this appears to be so for whole industries as well as for important units in those industries—some companies experience new trends from time to time due to changes in the financial structure and methods of production as the business of the company expands. But the straight-line trend of the expenses at higher or lower levels appears to persist for a span of years.

As a general rule, they say, costs are reflected in prices; that is, prices are adjusted to costs (except in some instances under regulatory controls). It is these adjustments that appear to control and maintain the consistency of pattern over a span of years. It will be recalled that Professor Joel Dean observed, in this regard, that "... the assumptions of constant selling price and essentially passive selling cost adjustments are more realistic and useful for short-run adjustments under normal conditions than economic logicians might think...." In another work he refers to the cost-plus pricing formula in industry as a possible explanation for the linearity of the cost function in relation to sales.

Rautenstrauch and Villers refer to changes in a company's financial and physical (resource) structures, to changes in the economic environment, and to the fact that, with these changes, the expenses of operations per unit of output will stand at different levels over a period of time. The profit and loss chart reflects the economic consequences of all of these changes over a span of years. They state, however, that the items of expense have different relationships in respect of sales and that these need to be clearly defined if the general pattern of the relation between sales and expenses is to be dealt with intelligently.

The Break-even Chart

It is the function of the break-even chart to show the relationship between sales and expenses at a given time. For the purpose of clarification, Rautenstrauch and Villers distinguish this type of chart from the profit and loss chart.

The historic pattern of sales-expense trend experienced by a company over a span of years (the profit and loss chart) will be expressed by the equation—

$$e = k + vx$$

where

e = expense,
k = the ordinate of the point of orientation of the trend line,
v = the slope of the trend line, and
x = sales.

Whereas the sales-expense trend of a company at any particular time (the break-even chart) will be expressed by the equation—

$$y = a + bx$$

where

y = expense,
a = constant total cost,
b = ratio of variable total costs to sales,
x = sales.

The method of drawing a break-even chart is illustrated in the text.[8] The first chart is based on "... definitely budgeted expenses for salaries and other items and for current material costs and wage rates ...", and the relationship of expenses to sales is for sales at a constant selling price. With a norm based on current conditions as to unit prices and unit costs, the authors point out that it is "... not only possible to show the probabilities of profit or loss for varying sales income under current conditions of operation, but also to show how profit and loss will depart from this norm upon changes in prices and costs of materials and wages."

A second type of break-even chart is explained where the X-axis is laid off in terms of physical quantities of output instead of money value of sales. The application of the break-even chart and the profit and loss chart to problems of investment and to problems of management is considered in some detail: break-even analysis is applied to products, to divisions of the business, and to departments.

A technique for the adaptation of the chart to changes in any element of variable or constant expense and to changes in selling price is discussed and illustrated. An

[8] Chapter IV, *The Economics of Industrial Management*, 1949, Rautenstrauch and Villers; my copy from the Grahame Book Company, Sydney.

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appendix includes details of three applications where the break-even chart has been adapted to meet the particular characteristics of the expense and income factors in those situations, demonstrating fairly convincingly the flexible nature of break-even analysis when properly applied.

DEFINITIVE RESEARCH BY PROFESSOR JOEL DEAN[9]

Professor Joel Dean has been "... intensely interested in the problem of overcoming the deficiencies of static break-even analysis in order to make it a [more] useful forecasting and management tool..." and his work should be closely studied by anyone who is directly concerned with the practical application of break-even analysis.

His work includes a paper on "Cost Structures of Enterprises and Break-even Charts,"[10] 1948. In relation to these empirical studies of costs on a statistical basis, Rautenstrauch and Villers observe that Professor Joel Dean has pioneered the field and thrown light on important and, up till then, little known matter. Professor Dean has indicated to me that some further work has been done on the problems of break-even analysis, and I am hopeful that at a later date it may again prove possible to present to readers of *The Australian Accountant* the results of further research by him.

In relation to the type of analysis pioneered by Rautenstrauch and illustrated in earlier works than the one dealt with in this paper, Professor Dean has observed that it represents a migration path break-even chart developed from annual data with no correction for the substantial changes that have occurred in dynamic factors such as prices, efficiency, technology, and plant. Output is measured by sales volume in current £'s rather than by an index of physical production. A sort of dynamic total cost function which appears to be linear and which often shows only moderate scatter was obtained. He goes on to say that sometimes sub-groups of consecutive years show different lines of fit. The result is not a static total cost function, but a movement path on a series of shifted static functions. He advances the same explanation for the linearity of this path as was mentioned earlier, namely, cost-plus formula pricing by the enterprises studied, and goes on to observe that a sort of dynamic profit function can also be determined directly by the correlation of historical profits and output, with constancies abandoned.

It may be noted that in the latest work by Rautenstrauch and Villers an attempt is made to make provision for the adaptation of the technique of break-even analysis in order to produce results which do take into account the effect of most of the changes of the type regarded by Professor Dean as being important. It must be conceded, of course, that not everybody can undertake the fairly rigourous statistical analysis of the type represented by the work of Professor Dean. His work on the short-run static cost function of a hosiery mill is of particular interest insofar as it tests the hypothesis as to the linearity of the cost function. It does not include material on the profit function.

Linear Cost Function

For a range of from 72,000 to 480,000 units per month, within the capacity of the plant, the finding was that "... total combined cost is linearly related to output over the observed range of output...."

[9] Dr. Joel Dean is a graduate of Pomona College, California (A.B.), of Harvard (M.B.A.), and of Chicago (Ph.D.) Universities. He is now Professor of Business Economics at Columbia University and a partner in Joel Dean and Associates. Previously he was associated with the International Business Machines Corporation; was Assistant Professor of Economics, Indiana University; Industrial Engineer, McKinsey Wellington & Co., Chicago; Executive Secretary, Conference on Price Research, National Bureau of Economic Research; Director of the Institute of Statistics and Assistant Professor in the School of Business, University of Chicago; Price Executive in Charge of Machinery, Office of Price Administration, Washington, D.C., and Director of Fuel Rationing; and Management Consultant, McKinsey & Co., New York. He is a member of the American Economic Association, the Econometric Society, the Controllers' Institute, the American Management Association, the American Statistics Association, the Institute of Mathematical Statistics, and the American Marketing Association. He is also the author of a number of works relating to the statistical determination of costs and related matters, including pioneering work in break-even analysis.

[10] Republished, by special permission, in the October, 1949, issue of *The Australian Accountant*.

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Tests using a cubic function were applied to see whether the observed results were consistent with the linear hypothesis and, in order to provide a basis for discriminating between linear and curvilinear regression functions, both second and third degree parabolas were fitted to the monthly observations of cost and output.

Up to the limit of practical single-shift operation with the existing plant, a linear total cost function seems justified. Further statistical refinements of the data in order to get more precise estimates of the cost function by, e.g., mathematical methods of multiple correlation analysis, deflation, lag corrections, etc., are expensive; and, when shifts in the cost function occur, due to dynamic changes, these in themselves cause some estimating errors, so that the error-range from the simpler and cheaper methods is generally tolerable from a practical point of view.

Static Revenue Function

A static revenue function may be ascertained for any given set of assumptions without any special difficulty. The assumptions are held available reflecting estimated changes from price variation, product-mix, and channel-mix, for these things are held constant in each given set of circumstances. If this is understood the revenue function in each case will still be linear, but the break-even point will shift.

Changes in list-prices or in rebates, discounts, or other price adjustments, actual or estimated, call for a new sales line, which alters the break-even point and the profit function.

Variations in product-mix, whenever the products differ in profit contribution margins, call for a different revenue function for each significantly different product-mix.

Variations in channel-mix, whenever the profit contribution margin varies as between channels (e.g. trade channels and non-trade channels), will also shift the revenue function. When the proportions going into different channels are important and unstable and/or correlated with activity rate, a different revenue function is required for each significantly different channel-mix.

It is possible to overcome some of these difficulties by calculating revenue as a single-valued function of a corrected output level, but in doing so the difficulties are reintroduced in a more complex form into the processes of determining the cost function.

No Automatic Forecast

The charts do not automatically provide a reliable forecast of future profits; the break-even point and profit level indicated is based on a continuation of to-day's relative prices and expenditures patterns; for profit forecasting over any long range, the break-even chart alone is a too simple and restrictive device. It assumes that profits are a single-valued function of activity rate—something which is approximately true for short-run fluctuations over a moderate output range and progressively less true as the time period and the range of output increase.

The break-even chart is still, of course, a dramatic comparison of several functional relationships on one chart, but is only one of the many tools available to modern management.

Most of these limitations are actually or tacitly recognised by Rautenstrauch and Villers.

Achieving Flexibility

It is necessary, as Professor Dean has observed, to modify and to manipulate the static break-even charts—"modify" in the sense of changing basic concepts, valuations, and forms of cost and revenue; and "manipulate" in the sense of changing the underlying assumptions and the levels of cost prices, product prices, and product-mix. There must be an adaptation and an extension of the technique of break-even analysis to embrace anticipated results under the various alternative courses of action which management may choose. This flexibility is achieved by preparing not one set of curves, but a series of curves in which there are separate cost and revenue functions for alternative management strategies—except in those circumstances where it is more practical to present the information relating to alternate courses of action in tabular form.

The prerequisites to a successful job of adjusting the static break-even charts are: an intimate familiarity with the method of analysis of the underlying data and the construction of the static chart; a thorough

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knowledge of the assumptions underlying any particular chart; and an understanding of the management problems for which the adjustments are to be made. This understanding of method, limitations, and assumptions is essential.

Break-even analysis may be made broadly flexible enough to facilitate rapid modification. For this purpose the data must be so marshalled as to enable changes in wages and prices and cost components and products *et al.* to be reduced rapidly to diagrammatic form.

VIEWS OF OTHER WRITERS ON BREAK-EVEN ANALYSIS AND THE CHARTING METHOD OF PORTRAYING RESULTS

Rowland and Harr recognise three basic forms for the break-even chart:

(1) the plan of showing fixed and variable expenses separately for the major classifications of the business,
(2) the plan of showing all fixed charges at the bottom of the chart, and
(3) the plan of separating "fixed" charges into depreciation and burden but showing both groups above the variable expense.

Pinkerton does not use the mathematical technique of Knoeppel, but fits a "straight" line by inspection.

F. V. Gardner does not automatically use sales as a base, stresses the importance of a proper measure of output to which all costs can be related, and uses a variety of charting methods.

Both of these writers use, and defend their use, of a scatter diagram, and Gardner says of the charting method that it "... produces all that could be expected in better control."

Asa S. Knowles, Dean, School of Business, Rhode Island States College, and Robert D. Thomson, Associate Professor of Industrial Management, North-eastern University, use the standard profitgraph for illustrative purposes, but go on to deal with what they describe as the cost curves of property management, in which they draw highly generalised curves to portray their concept of the "laws" of increasing and diminishing returns in relation to a given piece of physical property without adequate regard to unused or idle capacity. This idea, borrowed from the realm of theoretical economic analysis, is not so useful in the analysis of accounting data. Professor J. Maurice Clark has demonstrated this quite convincingly in his work on the incidence of overhead costs.

Roy A. Foulke (Vice-president, Dun & Bradstreet, Inc.) discusses six examples of a break-even chart:

(1) is a simple break-even chart showing the typical straight line relationships and introducing explicitly for the first time the concept of the "area of the break-even point". He notes an explanation by E. Dillon Smith that "... the region within which the most probable value of the break-even point may be expected to be found can be shown statistically to be a flattened oval. This outline of the area is due to the non-normal distribution of the deviation..."
(2) is also a typical chart showing straight line relationships of variable expenses, fixed expenses, total expenses, and net sales.
(3) shows "fixed expense" horizontally.
(4) shows a practical modification to straight line relationships and makes reference to an article by H. R. Mallory in *Mechanical Engineering*, August 1933, on "The Break-even Chart," which gives a practical explanation as to how allowance may be made for expense variations disproportionate to sales.
(5) shows and charts the principal divisions of fixed expense.
(6) illustrates a detailed chart such as the frontispiece to C. E. Knoeppel's *Profit Engineering* (1933). The development of this detailed chart is attributed to E. S. La Rose (1931).

Foulke makes the following general comment:

"The conventional break-even chart is plotted on straight line relationships which assume that variable operating expenses and total operating expenses are directly proportional to plant activity. It is also assumed that the items classified as fixed expense remain constant throughout the entire range of activity from zero to 100 per cent. These assumptions are sufficiently accurate for all ordinary purposes.

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"As an every-day practical matter, however, the variable indirect expenses cannot be controlled to make them exactly proportional to plant activity at all levels.... It is possible to determine an extra allowance for such items and to add that allowance to the theoretical variable expense. When such an extra allowance is made the variable expense line may be found to be a slight curve instead of a 'straight' line." [11]

Professor Dexter S. Kimball (Cornell University) and Dexter S. Kimball, Jnr., factory manager of the Bendix-Westinghouse Automatic Airbrake Co., point out that the total expense of production is, in general, divisible into two classes, which they describe as constant and variable. Constant expense includes all items necessary to the mere existence of the business, in contrast to variable expense, which includes all items connected with the activities of the business. Constant expense, as they define it, remains practically uniform and is little affected by volume, except occasionally, when a significant increment may lift the constant expense to a new level. Variable expense is, in their view, affected quite sensitively by a change in the volume of business, though not usually in direct proportion.

One of the difficulties inherent in break-even analysis may be perceived in the point made that the additional power consumed by a unit of plant beyond its idling demand is, in general, a function of volume which could be expressed by the equation—

$$P = C + f(V)$$

where

P = power required,
C = a constant,
$f(V)$ = some function of the volume of work.

Other expenses, again, are a function of time.

Professor Kimball's view is that, in the more complex plants with a variety of products, some of the variable expenses may not have any definite relation to volume of product and may vary in an irregular manner. Nevertheless, he says, "... the general principle of the [break-even] chart is instructive and the diagram is very useful in studying the effect of changes in fixed and variable costs."

In the joint work by Bethel, Atwater, Smith, and Stackman the standard break-even chart again makes its appearance, on this occasion being described as a profit-graph. The illustration, relating to an actual case history, was taken from *Factory*, issue of October, 1942, and relates to the Stanley Manufacturing Company, Dayton, Ohio.

In another illustration, a generalised curve of total cost (with six bends) is spread over three-shift operation. Curves of this kind give a nodding recognition of the difficulties involved in determining the shape of the cost function beyond the limits of practical single-shift operation, although highly generalised and requiring support from empirical studies on a statistical basis before they may be applied to practical situations.

Walter Scott is the only Australian writer who has dealt with profit control and differential costs, including the profit control chart, in a standard work. His treatment is primarily illustrative of the general principles involved. He adopts the standard "straight-line" form for the chart used in his text.

Professor John J. W. Neuner (College of the City of New York), using a break-even chart of the type (2) referred to above, comments on the procedure necessary to construct such a chart, and adds: "... there are many variable factors, however, which will restrict the use of such a chart."

The chart illustrated in "Developments in Cost Accounting" is purely illustrative, and there is no attempt in the text to develop or to discuss the theoretical concept behind its construction.

Professors F. E. Croxton and D. J. Cowden (Columbia University) illustrate a chart, also of the type (2) referred to earlier, commenting that "... in other situations one or more of the lines may be curved..." and "... if more than the break-even quantity is sold some profit will be realised...."

J. H. McDonald refers to the chart as "... a simple graphic presentation of

[11] Professor Joel Dean has observed, in relation to this recurring question of curved vs. "straight" lines: "... In my own experience, the niceties of choice among techniques of trend-fitting are not worth the trouble, since the differences in results are small compared with the error that is introduced by imperfect corrections of the observations."

(Continued on page 131)

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master budget data . . .'' which budget ''. . . is merely the starting point. . . .''

Professor C. F. Schlatter (University of Illinois) discusses the effect of volume on costs and profits; he gives a somewhat extended treatment of the concept of differential costs and illustrates his text with a variety of charts, including the more conventional charts of the break-even type. He states that ''. . . all items of cost, except non-recurring items, are either fixed in amount over the usual range of volume or vary proportionally, or nearly so, with volume of production and sales. Because this is generally true, total costs and net profits are greatly, but not proportionately, affected by the fluctuations in volume of business.'' He goes on to say, in relation to the break-even type of graph, ''. . . the real purpose of these graphs is to give visual expression to possibilities and probabilities. The purpose can never be to find exact and true amounts of total and differential costs. . . . In many businesses the lag of expenses and the variation in fixed expenses are so small that their effects on total costs are rather insignificant and therefore the simpler graph is usually adequate for the purpose of visualising differential cost. . . .''

CONCLUSION

It is less than 50 years since break-even analysis was first publicised in the U.S.A. In that short time the technique has been applied, successfully, by many executives and the officials of private and governmental institutions. The justification for the continued use of the technique and its associated charts has been its success as a management tool in the control of costs and profits—given a proper understanding of its limitations and the assumptions underlying the static charts.

The originators of the device understood its limitations fairly well and had, over a period of many years, made some progress towards improving their technique and defining the mathematical basis for it. These limitations were glossed over by a number of subsequent writers who, while making use of the device as an example of current practice in the control of profits and differential costs, continually abbreviated their references and in many cases left the reader with little more than the chart and a few words of explanation, quite insufficient for the purpose of dealing with practical problems. For this reason, the review of the developments in the application of the technique of break-even analysis given in this paper may serve to restore some balance to present-day concepts on this side of the world of the significance of break-even analysis. At the same time, I would emphasise that my primary purpose, apart from seeing to the decent interment of some exaggerated criticisms, is to stimulate interest in the subject.

Mr. Clinton W. Bennett, President of the National Association of Cost Accountants (U.S.A.), is quoted in the *New York Times* of 3rd October, 1948, as saying that ''. . . the break-even chart may prove one of the most valuable tools in management's kit.''

The principal works which will assist towards a better comprehension of the technique of break-even analysis are listed hereunder. The additional references given will enable any reader to examine, first-hand, the views of other writers, some of whom make valuable contributions. Those works which are specially recommended are marked hereunder with an asterisk.

Uses for Charts

The profit and loss chart, which provides a graphic record of the trend in expenses and profits as a function of sales over a period of years, and the break-even chart, which reveals the current economic characteristics of a business with its potential relation of profit to sales, both provide convenient means to management for the scientific control of operations. The profit and loss chart and the break-even chart are useful in analysis, forecasting, and control. Each has its particular adaptabilities. Together they provide the tools for working with a wide range of operating problems. Problems of investment and their probable economic effects on earnings, and problems of management of current expenses and their effect on the cost of production are, according to Rautenstrauch and Villers, the two main classes of problems in which these charts are particularly useful.

Break-even analysis investigates profit behaviour as a result of changes in volume and in other factors. There are many

A Dissertation—continued

policy and control problems to which break-even analysis and the associated charts may make some contribution, but any undue exaggeration of the versatility or effectiveness of this technique should be avoided. A sound structure of managerial controls must include many components in addition to break-even analysis.

Break-even analysis has definite contributions to make, including:

(1) The determination of the functional relationships between activity rates and costs, revenue and profits, make it possible to set better standards of profits, contribution margins, and expenses. These standards can be made flexible, not only to volume but to other changed circumstances.

(2) The conception and behaviour of controllable profits is formulated more precisely, so that its practical usefulness in managerial control is more clear.

(3) The determination of functional relationships to costs and to revenue provides a subsidiary control-device subordinate to controllable profits.

Further Reading

Profit Engineering, C. E. Knoeppel, 1933 (McGraw Hill Book Company).

Works by Dr. Walter Rautenstrauch:

Industrial Surveys and Reports, 1940.

The Design of Manufacturing Enterprises, 1941.

Principles of Modern Industrial Organisation, 1943 (Pitman Publishing Corporation).

**The Economics of Industrial Management*, Walter Rautenstrauch and Raymond Villers, 1949.
(Funk and Wagnalls Company, in association with *Modern Industry Magazine*.)

Works by Professor Joel Dean:

**Statistical Determination of Cost*, 1936.

**The Relation of Cost to Output for a Leather Belt Shop*, 1941.

**Statistical Cost Function of a Hosiery Mill*, 1941.

**The Long-run Behaviour of Cost in a Chain of Shoe Stores* (with R. W. James), 1942.

**Cost Behaviour and Price Policy* (with others), 1942.

References

**Variable Budget Control*, F. V. Gardner, 1940 (McGraw Hill).

Industrial Management, A. S. Knowles and R. D. Thomson, 1944 (MacMillan).

**Principles of Industrial Organisation*, D. S. Kimball and D. S. Kimball Jnr., 1947 (McGraw Hill).

Industrial Organisation and Management, L. L. Bethel, F. S. Atwater, G. H. E. Smith, and H. A. Stackman, 1945 (McGraw Hill).

Business Forecasting, J. H. Richardson, 1931 (Sir Isaac Pitman & Sons).

Cost Accountants' Handbook, T. Lang (Editor), 1945 (Ronald Press).

Cost Accounting, John J. W. Neuner, 1942 (Richard D. Irwin Inc.).

**Cost Accounting*, C. F. Schlatter, 1947 (John Wiley & Sons).

Cost Accounting, W. Scott, 1944 (Law Book Co.).

Practical Business Statistics, F. E. Croxton and D. J. Cowden, (2nd ed.) 1949.

Practical Budget Procedure, J. H. MacDonald, 1939.

Budgeting for Management Control, Rowland & Harr, 1945.

**Practical Financial Statement Analysis*, Roy A. Foulke (2nd ed.), 1950 (McGraw Hill Book Co.).

** In relation to the subject of break-even analysis, these works are considered the most important and are specially recommended.*

CURRENT PROBLEMS DISCUSSED IN OVERSEAS JOURNALS

ACCOUNTING THEORY AND PRACTICE

In our reading this month we have been particularly struck by the wealth of contributions made to overseas journals both in U.S.A. and the United Kingdom in the late months of last year. One particularly interesting feature of the several contributions which are mentioned hereunder is the unanimity of opinion that, whilst developments in the last decade or so have been extraordinarily rapid and far-reaching, there is still much to be done, and prospective changes in both theory and practice may be even more pervasive.

For example, Anson Herrick, reviewing recent developments in accounting theory and practice in *The Accounting Review*, October, says that the most important recent development is the rapidly-increasing

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awareness of accountants of their social responsibilities. Nevertheless, he thinks that accounting, so far, has failed in its obligation to present adequately the story of business. Financial statements are commonly presented in such a manner as not to be readable or understandable by the average investor or by labour. There have been some attempts to meet this criticism, and progressive extension of such attempts is not the least interesting development. Mr. Herrick is a strong advocate of the use of the source and disposition of funds statement. It is unfortunate that its adoption has not been more general, but the use of the title "funds" is unsatisfactory. Some such title as "provision and employment of working capital" would be preferable. Attention is directed particularly to the work of the American Institute of Accountants' Research Committee in such respects as the refining of accounting terminology, investigation of the nature of business income, the form of the income statement (with particular reference to the treatment of extraordinary items), and depreciation accounting.

The central problem to-day in the study of the nature of business income is, of course, the effects of rapid changes in the value of money. This is being closely examined by a study group financed by the American Institute and the Rockefeller Foundation. Stock valuation and depreciation accounting are both important from the standpoint of their effect on income determination. The lower of cost or market rule for stock valuation is illogical. The only proper basis is cost, subject to the provision that when some part of cost has lost its usefulness for profit-making in the following period, the measure of such loss should be accounted as a cost of doing business within the period ending on the inventory date. Mr. Herrick dislikes the LIFO method, and he examines its defects in some detail. For depreciation accounting, the Institute's Committee has steadfastly maintained its adherence to the cost basis, but accelerated depreciation for use of assets in excess of normal production rates is becoming popular in U.S.A.

The article concludes: "The art of accounting is progressing. Recent developments have done much to sharpen the significance of stated net income, and the usefulness of financial reports. But much yet remains to be accomplished in meeting the social responsibilities of the profession."

George O. May, in *The Accountant* of the 30th September, on the subject of business income, regards accounting as "resting on a framework of postulates and assumptions which are accepted and acceptable as being useful, not as demonstrable truths, and the usefulness of which is always open to reconsideration." The three most fundamental of the postulates are:

(a) the realisation postulate, that income arises at the point of sale,
(b) the monetary postulate, by which fluctuations in the value of money are ignored, and
(c) the postulate of permanence, that each accounting entity is a continuing enterprise.

The historical development of these three postulates is examined. Mr. May's own view is that revenue and charges against revenue should both be measured as nearly as possible in units of the same purchasing power.

"Accounting and Economic Business Profit," by Hermann C. Miller, in *Cost and Management*, October, is an examination of economic theories as to business profit found in recent writing, and a comparison of these with traditional or conventional accounting concepts of business profits or business income. Mr. Miller concludes: "Profit resulting from production reflects the commitment made when he entered into business, made decisions relative to operations, and gives him a better understanding of his relative position with competitors who have entered business at other dates and on other price levels, or who in the cycle of replacement may have found it necessary to reinvest earlier in portions of plant at a higher or lower price level. Certainly, that business man who acquired plant at lower price levels than now prevail and who still uses the original plant will need the additional help which accountants are, I believe, best qualified to offer in deciding how much of the 'production' profit is available for current consumption and how much should be saved for ultimate replacement of plant or inventory at a higher price level. This is the fourth and highest role which the accountant plays in the chain of recording, classifying, reporting and interpreting."

In *The Journal of Accountancy*, October, T. H. Sanders makes an analysis of the

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forces which are shaping the future of accountancy. He expects significant changes in methods of determining income, and in the relationships of industry, the auditor, and governments. If changes are to be made in accepted practices, they must be related to modifications in the assumptions on which such practices are based.

In *The Journal of Accountancy,* November, Percival F. Brundage discusses the influence of government regulations in the development of to-day's accounting practices. Government regulations has perhaps been a more potent influence on the practice of accounting in U.S.A. than in the United Kingdom and Australia, and the rules and pronouncements of regulatory commissions such as the Interstate Commerce Commission, the Securities and Exchange Commission, and the taxing authorities have for a very long time materially affected accounting in that country. Incidentally, after reading the article one is led to hope that a similar examination may soon be made in Australia.

In the same issue of *The Journal of Accountancy,* Samuel J. Broad stresses the need for continuing change in accounting principles and practice. There is an evident danger of accounting principles made by order from government agencies being frozen at the time of making. There is an equally evident need for flexibility. Mr. Broad discusses the function of principles and individual judgment in determining the content of a financial report, and illustrates his article by reference to the new forms which financial statements are now taking. Experimentation of this kind is a sign of virility. "If we can make a better mousetrap, people will use it."

The Cost Accountant, October, contains Prof. W. T. Baxter's paper at the First Summer School of the Institute of Cost and Works Accountants, on "Accounting for Inflation: Viewpoints of the Economist and the Accountant." Prof. Baxter examines the effects of inflation on the profit and loss account and the balance sheet, and proposals for stabilised accounts, as to which he doubts whether they would be intelligible. He describes himself as a convert to replacement cost provision as a result of experiences of the last few years.

Also dealing with accounting and price-level changes, Norman Spencer, in *The Accountants' Journal* (N.Z.), September, suggests an asset valuation technique and more equitable taxation allowances. For taxation purposes he thinks that current values should be used, such current values to be certified by professional valuers. For accounting, "true" profits and "true" asset values should be used. Depreciation should be calculated at appropriate rates on the current value of assets used.

Still another article on the subject of accounting and inflation is by K. Engelmann, in *The Journal of Accountancy,* October, entitled "The Realization Basis of Determining Income Would Eliminate Distortions Caused by Inflation." Mr. Engelmann believes that the problem of accounting for inflated income could best be solved if the principles were observed that:

(a) income is to be determined on the basis of realized transactions only, and

(b) the realized income is to be adjusted on the basis of its replacement value.

In the accounting literature of the last 20 years there has been a good deal of controversy as to the relationships and distinction between such terms as principles, standards, conventions, rules, postulates, concepts, and so on. In the second of two articles on inductive reasoning in accounting, in *The New York Certified Public Accountant,* November, Prof. A. C. Littleton discusses these relationships.

PUBLISHED ACCOUNTS

The Accountant, 21st October, contains a particularly interesting lecture by W. G. Densem, which was given at the Fourth Summer School of the Institute of Chartered Accountants in England and Wales. Dealing with the requirement under the new Company Law that public accounts shall be true and fair, Mr. Densem raises the question: To whom are the accounts to be fair? He believes that they should be fair to the members of the company, the majority of whom are untrained in accounting methods, procedures, and conventions; and from this standpoint he discusses the implications in respect of such matters as form, use of comparative figures, treatment of share premiums, pre-acquisition profits, reserves, movements in reserves

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and provisions, fixed assets, interests in subsidiary companies, intangible assets, current assets, the profit and loss statement, the treatment of exceptional or non-recurring items, stock valuation, and provision for depreciation.

In *The Accountant,* 16th September, W. G. Campbell has the third and last instalment of a paper on the subject of the auditor and the Companies Act, 1948. This part deals with group accounts and their presentation, the general requirements affecting subsidiary companies, and exceptions for special classes of companies. There are interesting comments on the substitution of the word "fair" for "correct." By contrast with Mr. Densem in the article referred to above, Mr. Campbell takes a wider view of the meaning of fair. "The question is sometimes raised as to whom the presentation is to be fair, and the answer seems implicit in the Act that the scales are to be fairly held between the interests of the company as a commercial undertaking and the interests of all who are concerned with its accounts, the shareholders and creditors at the date of the accounts, potential members of either class, the directors, and, in exceptional cases, the economic interests of the country. The former conception of an auditor as a watch-dog of the shareholders, only barking on their behalf, has been gradually weakening for years and cannot survive the implications of the 1948 Act."

Jerome G. Futerman and George V. Delson, in *The New York Certified Public Accountant,* September, discuss full disclosure and the surplus statement. They maintain that the practice of full disclosure should not be confined to present conditions or future commitments and contingencies, but should also be extended to historical information and analysis. The point is illustrated by an example of the treatment in specimen accounts of a reduction of capital in order to eliminate accumulated losses.

In *The Accounting Review,* October, Sidney Davidson states the arguments against setting up reserves for sinking funds to discharge debt. In the case of government utilities, this practice means, in effect, that one generation of ratepayers or users is required to pay for two plants. In the case of private concerns, pricing decisions are unaffected by such reserves, but their effect on dividend policy may be undesirable.

MANAGEMENT ACCOUNTING

In 1950 a British accounting team visited U.S.A. to investigate management accounting in that country. *The Cost Accountant,* December, contains extracts from the team's report. These extracts cover the general survey, conclusions, and recommendations. Matters dealt with include the effectiveness of management in U.S.A., its fearlessness in trying new methods, price arrangement, organisation structures, the provision and use of information, published reports and accounts, methods of obtaining information, and education for management.

Ian T. Morrow, in *The Cost Accountant,* November, discusses cost accounting as an aid to the measurement of productivity. The solution to the problem of measurement of productivity has not yet been found, but cost accounting may provide it. The problem is how to measure productivity with sufficient accuracy to enable comparisons to be made between one factory and another.

In *The Accounting Review,* October, L. J. Benninger, on standard costs for income determination, control, and special studies, sets out to place standard cost accounting, its aims and methods, in proper perspective within the whole field of accounting. He thinks that maximum benefits from standard costs may be achieved by integration with financial accounting, an integration particularly of aim.

In the same issue of *The Accounting Review,* Carl Thomas Devine, on cost accounting and pricing policies, points out that the assumption, usual among cost accountants, that prices should be high enough to cover total unit costs is influenced by classical and neo-classical economic theory, based upon the presumption of perfect competition. Modern economists have moved away from these theories to studies of imperfect competition, short-run considerations, and an examination of the complications arising from joint costs and multi-process production. "Costs," says Mr. Devine, "are only one of many determinants of price." He proceeds to examine the uses of marginal costs, and the problem of allocation of fixed charges to unit costs.

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Josef Goliger, "Fixed Charges and Profit," in *The Accounting Review*, October, is a short examination of the dependence between the fixed charges rate (the ratio of fixed charges to sales) and the profit rate (the ratio of profit to sales).

The Cost Accountant, October, contains a paper by G. T. Verrall, to the First Summer School of the Institute of Cost and Works Accountants, on statistical control for top management.

Descriptive articles on costing for specialised businesses, in the nature of case studies, which have come under notice are:

"Costing for Cycle Manufacture," by T. W. Badgery, in *The Cost Accountant*, November.

"Brewery Cost Accounting," by Herbert C. Geyer, in *The New York Certified Public Accountant*, November.

"Distribution Costs in the Bottling Industry," by Jack L. Caldwell, in *The New York Certified Public Accountant*.

"Food Cost Control," by Henry W. Espersen, in *Cost and Management*, September.

"Cost Accounting in a Diversified Food Industry," by J. Grant McKnight: the first of a series of two articles in *Cost and Management*, October.

"Estimate Costing," by R. M. Kay, in *The Accountants' Journal* (N.Z.), November: a descriptive article including a month's specimen entries for a hypothetical factory.

"Design and Installation of an Accounting System for a Chain of Grocery Stores," by Richard F. Stone, in *The New York Certified Public Accountant*, November.

"Welcome, Stranger: Control of Hotel Guest Accounts," by John I. Marder, in *The Canadian Chartered Accountant*, November.

STOCK-IN-TRADE

In *The Canadian Chartered Accountant*, September and October, the second and third instalments of an article by Garfield G. Goult appear. The first instalment appeared in the August issue. These trace the growing, though still undefined, responsibility of the auditor in respect of stock-in-trade.

In *The New York Certified Public Accountant*, October, George C. Watt has some notes on the observation of physical inventories. The article includes a check list for a physical inventory work programme.

Bulletin No. 5 of the Committee on Accounting and Auditing Research of the Dominion Association of Chartered Accountants deals with the meaning of the word "cost" as used in inventory valuation. This bulletin is reproduced in *The Canadian Chartered Accountant*, November. Its keynote is that the method selected for determining cost should be one that results in the fairest matching of costs against revenues, regardless of whether or not the method corresponds to the physical flow of goods.

F. Underdown, in *The Cost Accountant*, November, discusses the valuation of finished stocks and work in progress for periodic accounts. The methods described are those which may be used either in cases where there are double-entry cost records or where there is a system of integrated cost accounts. Particular attention is given to adjustments to the valuation in respect of overhead, new products still in process, and standard cost variances.

AUDITORS' REPORTS

A particularly interesting account of the evolution of the auditor's report in the U.S.A. is given by George Cochrane in *The Accountant*, 4th November. Mr. Cochrane gives emphasis to the effects of various bulletins of the American Institute of Accountants, legislation such as the Securities Act, correspondence with the New York Stock Exchange, and spectacular cases such as the *Ultramares Case*, 1931, and the *McKesson-Robbins Case*, 1939. Evolution of the auditor's report has followed a different course in U.S.A. from that in the United Kingdom. In the United Kingdom the development of the accountancy profession has rested to a much greater extent upon statutes. In U.S.A. authoritative standards of practice rest on a form of common law based upon the decisions of the organised profession and the acceptance of such decisions by the public at large. Changes in the field of auditing in U.S.A.

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have been designated very largely by concrete economic circumstances, intermixed with important ethical considerations flowing out of changing ideas about management responsibilities to the public. Nevertheless, in spite of differences in evolution, the basic goals of the profession in both countries have remained similar. Auditing is conceived as "a group of techniques for measuring, checking and evaluating business progress, in a spirit of independence and objectivity."

The Committee on Accounting Procedure of the American Institute of Accountants recently issued Auditing Statement No. 23, entitled "Clarification of Accountant's Report when Opinion is Omitted." The history of this statement goes back to statement No. 1, issued in October, 1939, the first pargraph of which said that independent public accountants should not express the opinion that statements present fairly the position of a company, and the results of its operation, in conformity with generally-accepted accounting principles, when the exceptions made in the report were such as to negative the opinion, or when the examination had been less in scope than the accountant considered necessary. In such circumstances, the accountant should limit his report to a statement of his findings, and, if appropriate, his reasons for omitting an expression of opinion. Statement 23 revised and extended this part of statement 1, making it clear that the auditor should put the reader on notice as to whether or not a given financial statement was audited and had the auditor's approval. This extension was clearly aimed at ambiguous reports or at attempts to avoid responsibility without clearly disclaiming it.

Arthur M. Cannon, in *The Journal of Accountancy*, November, examines the significance of Auditing Statement 23 in relation to accountants' legal liabilities. The article throws much interesting light on the validity in U.S.A. of generally-accepted auditing standards. Statement 23 is also the central feature of an article by Stephen Chan in *The New York Certified Public Accountant*, October, entitled "The Accountant's Opinion Before and After Auditing Procedure Statement No. 23."

Recently, several auditors' reports in U.S.A. have been simplified and condensed to read, so far as the expression of opinion is concerned, somewhat as follows:

"In our opinion, the attached financial statements fairly present the position of A.B.C. Corporation and its subsidiaries at December 31, 1949, and the results of their operations for the year then ended, in conformity with generally-accepted accounting principles applied on a basis consistent with that of the preceding year. Our examination of such statements was made in accordance with generally-accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances."

In *The New York Certified Public Accountant*, Alden C. Smith examines the suitability of this form, and its flexibility to cover cases in which qualifications are necessary.

Frank V. Russell, in *The Journal of Accountancy*, November, maintains that accounting firms can write better long-form audit reports. He attacks the question along the three lines of the structure of the report, its content, and how to organise it, and includes pertinent suggestions as to the preparation and review of working papers and how to evaluate reports written by others. Each report should be different. There is no generally-accepted uniformity of arrangement, but preference is expressed for the following sequence:

1. Introduction.
2. Scope of examination.
3. Historical background of business.
4. Review of operations and comment thereon.
5. Description of balance sheet items and examination of procedure.
6. Insurance coverage.
7. General comments.
8. Accountant's opinion.

The source and disposition of funds statement is regarded as essential, probably at point 4.

PROFESSIONAL PRACTICE

Two articles by Clive de Paula, in *The Accountant*, 23rd September and 30th September, deal respectively with how accounts of the professional accountant can be designed to establish control of costs and to establish the cost of work done for

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different clients, and with incentives in a professional office.

Problems of the practising accountant are also discussed in three articles in *The Canadian Chartered Accountant*, October. J. R. M. Wilson, on differences between audits of small and large businesses, thinks that the relative frequency of fraud is greater in small than in large businesses, because of better internal check in the latter. Hence greater attention must be paid in small audits to audit technique designed to detect misappropriation.

Milton E. Mandel, on staff problems of the small accounting firm, discusses the selection of staff, training programme, supervision, and the value of staff meetings.

H. R. Sanders, on the role of the small practitioner, contends that smaller practitioners are in touch with the largest number of clients, and so help to formulate public opinion of accountants to a much greater degree than they realise. The wide variety of service which they render calls for ingenuity and versatility.

PROFESSIONAL EDUCATION

Prof. C. G. F. Simkin, writing in *The Accountants' Journal* (N.Z.), September, on accountancy and the university, discusses the relationship between the New Zealand Society of Accountants and the university colleges of New Zealand. Incidentally, he gives a dispassionate review of the claims of accountancy to be regarded as a university subject, and of the case for and against a chair of accountancy and a degree of accountancy. Prof. Simkin is a strong advocate of independent teaching and independent examining.

PUBLIC ACCOUNTS

Irving Tenner, on balance sheets for the Federal Government, in *The Accounting Review*, October, draws attention to the fact that no balance sheet is at present prepared for the Federal Government in U.S.A. Two principal obstacles to the preparation of such a balance sheet are the use of the cash basis of accounting and failure to recognise fund distinctions. He thinks that the government should establish three types of funds: general, to account for all assets or other resources owned by the government; trust, to account for assets held in its capacity as agent or trustee; and business-type, to account for transactions of business-type enterprises.

In *The Accountants' Journal* (N.Z.), November, W. Rosenberg, "When is a Deficit a Deficit?" distinguishes among five different interpretations of the meaning of deficit: over-all deficit, cash deficit, current deficit, consolidated fund deficit, bank-financed deficit.

SHARE VALUATIONS

A challenging article by A. J. Scott, Chairman of the Christchurch Stock Exchange, in *The Accountants' Journal* (N.Z.), November, disagrees with all the usual accountancy methods of valuing shares. So far as listed stocks are concerned, the stockbroker's view is that these are best valued by taking the latest quotation, with allowance for the size of the parcel. The valuation should not be reduced, however, because a large parcel is available for sale. As to unlisted shares, Mr. Scott rejects the idea of using asset backing as a determinant, and advocates the simple method of capitalization of earning capacity.

The addresses of publications referred to in this article are as follows:

The Accounting Review,
450 Ahnaip Street,
Menasha, Wisconsin, U.S.A.

The Accountant,
4 Drapers Gardens,
Throgmorton Avenue,
London, E.C.2, England.

Cost and Management,
66 King Street East,
Hamilton,
Ontario, Canada.

The Journal of Accountancy,
270 Madison Avenue,
New York 16, N.Y., U.S.A.

The Cost Accountant,
63 Portland Place,
London, W.1, England.

The Accountants' Journal (N.Z.),
York House,
Lambton Quay,
Wellington, C.1, N.Z.

The New York Certified Public Accountant,
677 Fifth Avenue,
New York 22, N.Y., U.S.A.

COSTS AND PRODUCTION STANDARDS

by

HAROLD B. WILLIAMSON, A.I.C.A.

PART I

INTRODUCTION

This series of articles will set out to detail a method whereby cost standards may be incorporated in the ordinary books of account and be utilised for any type of production costs, whether it be job order or single product, process or total costs.

The main essential is capacity, whether it be peak or any part of peak; and any factory which goes into business speculating as to whether it can attain and retain a profitable capacity deserves to, and will, fail.

A firm must know its capacity to make and sell in machine or labour hours, and with that knowledge it is but a short step to budgeting for standard hours. When that position has been reached, the whole production schedule can be set out to deal with non-standard or jobbing orders and standard production.

Only one further essential is needed, and that is the knowledge that labour can be depended upon to turn out a specified volume in a specified time. Given the desired incentive, it will; and incentive is an element of cost standards which must not be ignored.

Many executives deprecate the full use of cost standards because they have found the time element unstable. That will always be the case when the employee does not receive that extra consideration which, if he is capable of attaining to a certain high task of production, he considers his due. When he does, then a standard rate of production is assured. Standards can then be set for job orders as received, as well as for mass production.

PRODUCTION STANDARDS

(1) Factory Organisation

(A) INTRODUCTION.—The complete costs technician requires not only a knowledge of the essentials of any costing system to be devised, but of the basis upon which any manufacturing project should be conceived, allied with technical knowledge of requirements necessary to set up and make that project function. Scientific costing, therefore, should be built in as an integral part of the original production machine; the costs technician or consultant fitting into the scheme as technical advisor; the desired end, complete standardisation.

Standardisation makes for the smooth functioning of an establishment and includes:—

(a) orderly lay-out of departments,
(b) functioning of staff,
(c) classification of products into types,
(d) appropriate mnemonic symbols representing types,
(e) analysis of operations,
(f) standardisation of equipment, tools, methods, and records.

The result may all be achieved if the organisation is set up along the following lines, from the original conception.

(B) CONCEPTION. — Business and production must be forecast and return be commensurate with the capital invested. The forecast should cover the probability that the product will be one well in demand, and take into consideration the likely degree of prosperity, not only in the near but in the distant future.

A factory opened or extended to catch a certain market or meet increasing demand for a certain article is an unsound proposition; it does not take into consideration the possibility of changing circumstances or unfavourable business cycles.

Business fluctuates from year to year; it may remain steady for a period, but the trend will probably be found to be upward or downward over a protracted length of

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time. General seasonal variations, given a certain annual volume, may be known from past experience; but the unknown quantity is the annual volume, and this will depend upon the prosperity of the people as a whole.

A study of the long-period variations in trade has proved, after eliminating seasonal influences and secular or long-term trend, that there is a definite cyclical fluctuation from depression through recovery to prosperity and back through recession to depression.

Forecasting trade movements is not easy, because the cycles are irregular—the height of the boom, the depth of the depression, and the recovery vary from cycle to cycle—but the general cyclical movement over any period in the near future can be estimated and due allowance made for the possibility of fluctuation.

Marketing is another problem to be overcome. It is necessary to be sure not only that the product can be sold, but that, if the goods are to be for home consumption, saturation point will not be reached: if it has, the object will be foreign trade, and here again economic and marketing conditions abroad, credit policies, banking practice, current and future exchange, and the probability of continual demand will need examination. With the home market the only object, the question of suitable territory and trade connections will require attention. The methods of possible competitors should be studied, agents allocated to work the territory, sales programmes organised, and present and future purchasing power of possible customers estimated.

Only from the tabulation of all these factors can be adduced the size of the plant to be constructed and the desired capacity for production.

(C) Works Lay-out.—Conservation and scientific arrangement of the space are the main factors in planning the factory lay-out.

The following matters should receive attention:—

(1) Choice of site.
  (a) Availability of personnel and staple materials.
  (b) Availability of trade services.
  (c) Transport facilities.
  (d) Disposal of waste and by-products.
  (e) Cheapness of water, fuel, lighting, and power.
  (f) Local building by-laws and restrictions.
  (g) Fire protection, sanitary, and hospital facilities.
  (h) Room for extension and auxiliary purposes, such as recreation and education.
  (i) Cost of land and conditions of tenure.
  (j) Local rates and charges.
  (k) Subsoil factors affecting building costs.
(2) Type of building.
(3) Proportion of buildings.
(4) Economical arrangement of space.
(5) Provision of light (natural and artificial), ventilating, and heating.
(6) Provision of power (normal and emergency).
(7) Internal transport: cranes, runways, trolleys, conveyors, chutes, lifts, etc.
(8) Arrangement for supervision and training.
(9) Arrangement for inspection.
(10) Arrangement for certifying work done under payment-by-results.
(11) Arrangement for regulating works-in-progress.
(12) Provision for tool supply and control.
(13) Provision for plant maintenance.
(14) Arrangement for flexibility of production, either as to kind or quantity.

(D) Type of Building.—The first considerations are congenial working conditions, hygienic surroundings, and good lighting. Only by creating such an atmosphere can good health and top efficiency be maintained.

Special-purpose buildings, such as breweries, power stations, or continuous-process industries, require special layouts, but with production plants there are certain layout principles. They are:—

(a) Producing units of a like character segregated, e.g. all milling machines in one department.
(b) Producing units arranged in sequence of operations, with no more gangway than is necessary for operators and traffic.

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The producing units should be so laid out as to be easily accessible for repair and transport of work, requirement being a continuous movement of all work in process controlled by allocation of some central floor space.

Power supply will be either by shafting transmission from some prime mover such as a diesel, or from electricity to drive motors for each machine.

(E) PLANT CONTROL. — Plant installation and control play an important part in the economic success of an enterprise: inefficient machinery leads to excessive overhead. The knowledge of when to discard any old equipment will lead to greatly increased efficiency and a greater profit-earning capacity. Costs and the capacity to test the production efficiency of all plant have so deep an administrative significance, are so closely interwoven, that the costs technician should be thoroughly conversant with the plant layout, the machines and tools available, production methods, and all necessary processes for any given type of product. He must be able to read his costs intelligently, because the very elements affecting plant selection are cost.

The cost of: tools, personnel, floor space, lighting, heating, power and fuel, maintenance, interest, depreciation, and insurance, plus liability to breakdown, and all fixed charges, are all affected by the type of machine installed, and for this reason he must know his machines and their capacity.

The costs technician should have a knowledge of machine operating and be able to read a blueprint, as he should be responsible for the final estimate of costs submitted. If estimates submitted are excessive, he must be able to analyse and, if possible, reduce them. His duties to the executive are ability to analyse machine methods, interpret costs' figures intelligibly and simply, and present data and suggestions which will affect costs' reductions and aid the management in forming its business policy.

The machine-shop foreman may be a highly-skilled mechanic; the production manager be highly efficient — but the former is not skilled in costs; and the latter mainly deals in line and staff organisation, motion and time study, and machine capacity. In any case, he is not as conversant with the significance of costs' figures as is the cost technician, who, for this reason, should know when it is more economical to replace a milling machine by a gear cutter, or when there would be a saving in costs if high-speed-steel tools on a turret lathe were replaced by cemented carbide for one particular line of production.

(F) PLANT MANAGEMENT.—This will be under the supervision of the plant engineer, and covers:—

(1) plant selection,
(2) plant records,
(3) plant maintenance,
(4) plant depreciation,
(5) power supply and transmission,
(6) pattern and tool control,
(7) fire and accident prevention,
(8) machine, fire, and accident insurance.

(G) FACTORY SIZE AND OUTPUT.—The greater the number and diversity of goods manufactured, the greater the amount of non-production work entailed in handling an order from the time of receipt to the time of shipment of goods ordered, and for this reason the greater the overhead. It is the non-productive work which affects efficiency and increases overhead, as there is less possibility of production on mass-production lines.

Instance the case of a factory manufacturing individual production to order.

If the factory were working under mass production, the parts required would be in stock. As it is, they receive the order, which is sent along to the sales' department, and probably from there to the technical department for details of raw material required. Returned by the engineer to sales, the necessary entries and records are made, and, if the goods are not in stock, an order is prepared for production control, with copies to inspection, shipping, and billing departments.

Production control will place orders on the purchasing department for outside material and parts.

Purchasing department will forward orders to outside suppliers, with copies to inspection, goods inwards, stores, and accounts departments.

Production control places orders on the shops for the manufacture of the parts and assembly operations, copies being sent to stores and inspection, and also prepares schedules and progress sheets so that departments may carry out their part in the

Costs and Production Standards—continued

production programme and the order be completed by required date.

Whatever the variation in this procedure, the factory handling many lines should be unable to compete favourably with that handling fewer, as overhead charges lessen in proportion as ratio of non-productive work lessens.

It is doubtful if, with an efficient manufacturing concern, any increase in profit per unit would take place with plant expansion. With increase in size of plant, variable expenses should decrease per unit of product, but this will be counteracted by the fact that constant costs will probably increase faster than variable expenses.

Where there is any change in equipment, the new process must save enough in variable expenses to cover depreciation and all constant costs on extra investment, plus costs of scrapping outmoded machinery.

The principles of vertical (integral) and horizontal combination go towards proving that size of concern is of little account, so long as there is no great variation in type of article produced.

Integration implies the central control of all stages in a production chain from producing the raw material to manufacture of the finished articles. A steel company mining its own coal and iron ore and processing to manufacture all types of finished steel products would come under this category. The savings possible are infinite: material purchased from outside sources includes a profit made by the vendor, a profit which, in the case of integration, remains within the concern; purchasing costs and personnel are practically dispensed with, the firm thus being able to direct the whole of its attention toward market demand for the manufactured article; and production through all processes is possible without the bottlenecks which otherwise so often occur, as scientific and co-ordinated control can be achieved at all stages and in all departments.

It would appear from the above, and is the case, that such a concern would tend to become a monopoly; but integration has been found in fact to act in the best interests of the community which it serves, the savings from control of all its factories and undertakings making for the manufacture of a cheaper article and one which, in many instances, is still raw material so far as any industrial purchasing organisation is concerned.

Horizontal combination implies the merging of several small organisations, all producing the same line of goods, into one large holding.

The merging — even of units widely separated—can result in cost savings, for, although production costs may not alter, there are phases of overhead, such as central administrative control, reduced unit administrative charges, wider and greater opportunities for research, reduced freight charges, etc., plus less fear of competition, which make for greater economy. Added to this is also the fact that production methods and costs in different concerns, even producing the same line of goods, are rarely similar, efficiencies can be gauged, and diversity of method analysed, with a view to still greater benefits.

The conclusions which can be drawn are:—

(1) A factory can be increased in size indefinitely without impairing economic efficiency, provided such increase is not accompanied by increase in diversity of goods manufactured.

(2) Increasing diversity of products (without increasing quantity of any particular one) usually results in increased overhead expenses and consequently rising manufacturing costs.

(3) Closing many small factories in order to concentrate manufacture of diverse products in one large one does not necessarily reduce overhead.

(4) Small factories producing few lines give better service than a large factory producing many.

(2) Functional Organisation

(A) Introduction.—As much consideration should be given the service side of the organisation as is received by the mechanical. Each function or service should be under the control of an officer particularly adapted to that type of work, his only consideration the efficiency of the department.

The more difficult technical and organisation problems of production, as distinct from shops operation, should be carried out in separate departments away from production centres; and the departments, each dealing with some technical or organising work to assist production, form what is

Costs and Production Standards—continued

known as the functional or line and staff organisation.

The size and number of these auxiliary departments may vary in every factory, but, whatever the factory, the same functions are carried out, with organisation somewhat as follows:—

(1) Administration (costs office, works manager, or engineer-in-charge) etc.
(2) Planning department.
(3) Progress department.
(4) Drawings and designs.
(5) Inspection department.
(6) Stores.
(7) Plant department.
(8) Research and experiment work.
(9) Tool room.
(10) Canteen and welfare.

(B) ADMINISTRATION. — Covers all administrative procedure, and, although the costs office is sometimes considered as a separate department, it may be included, as well as the works manager or engineer-in-charge, if he has administrative control. Amongst other things, it is the duty of the latter to authorise all factory orders.

The costs clerk receives from the progress department a copy of all orders and a set of specification sheets containing a list of the component parts of the article to be produced, with their symbol number, material requirements, and operations.

He makes out weekly material and wages abstracts and places them in the file behind the corresponding factory order and specification sheets.

All premium and time cards are forwarded to him after the wages clerk has calculated the wages.

(C) PLANNING DEPARTMENT.—This department draws up an instruction sheet (one for each operation) for the product as designed by the drawing office. The preparation of this sheet (operation study or planning) may be divided up into:—

(a) preliminary study,
(b) motion study,
(c) time study,
(d) time setting.

(a) The planner decides how each component is to be made, what operations are necessary, and the number which can be dealt with at one time. He may suggest alterations to the original design.

(b) Each operation is considered as to best type of tools to use, correct feeds and speeds of machine, and lay-out of work, so that operations may proceed expeditiously.

(c) Each operation is split up and timed to the minutest detail (fundamental elements), each element, termed a therblig, being any slightest motion or mental effort. Unit times are totalled up to arrive at greatest time for complete operation, no allowance of any kind being made at this stage.

(d) An instruction sheet is prepared for each operation, stating time allowed, this being greater than the quickest time obtained under (c), the exact proportion depending upon the wage system in operation.

The instruction sheet contains two columns: one (minutes) for the elementary operations on the piece; the other (fixed) for:—

(a) preparing the work, checking the tools, clocking in, etc.,
(b) handing over when the operation is complete, returning tools, drawings, etc. to store, clocking off, passing on completed work for inspection.

Complete co-ordination between this department and the costs office is essential for full standardisation and compilation of the budget.

The production engineer, in control, knows his capacity in machine and/or labour hours, and can estimate the type and quantity of raw material which will be used over any given period. Where it involves only production of definite and particular lines, all information as to operation time is available from production schedules compiled in advance to include all operations and times. The specification sheet contains all details as to material and operations, and as this should be forwarded to the costs office along with the production schedule, all information for the budget is to hand.

Standard progress charts, detailing procedure in advance, allow the costs technician to keep at his finger-tips the exact position with regard to real or true costs (standard) and actual costs at any given time.

(D) PROGRESS DEPARTMENT.—The production engineer informs the progress clerk of all orders and promised date of delivery. The clerk arranges the date of commencement and draws up a sequence of dates and

Costs and Production Standards—continued

times for completion of each operation upon a certain batch on a progress sheet.

Several copies of the progress sheet and factory order are made out and sent to departments concerned and the costs office.

The storekeeper is informed of requirements and material requisitioned as required.

The progress clerk attends to the movement from operation to operation.

(E) DRAWINGS AND DESIGNS.—All products made by the factory are designed in this department.

Complete working drawings, detail drawings, and specifications stating the kind and amount of material required for each component are prepared, one copy filed, one copy forwarded to the planning department, and one copy mounted and forwarded to the drawing store in the shops for the use of the workmen.

(F) INSPECTION. — All work must be checked at various stages and when completed.

Inspectors know the function of the completed product and of each part, and, with drawings, will check the sizes and pieces and subject them and the completed article to the requisite test.

(G) STORES: (i) CONTROL.—Efficiency in operation of plant and personnel requires the scientific placement, ordering, and control of all stock: this item embraces tools, stores generally, and production either completed or in process. Certain facilities and requirements are essential, viz.:—

(a) proximity to production centres;
(b) convenient internal and external transport;
(c) economic arrangement of space;
(d) systematic classifying, repairing, and storing;
(e) ample lighting and ventilation;
(f) hygienic working conditions.

Efficient production control will attend to the movement of all work in process; while finished goods, if not on order, can be transferred to stock by means of movement orders made out in triplicate and signed by the authorised officer. One order will accompany the stock to stores, one be forwarded to the costs office, and original retained. The costs office, upon pricing finished goods, will check them as to quantity with the movement order.

The entry to the stores ledger will be made by means of a manufactured-stock slip detailing factory order, quantity, price, and authority made out in duplicate; original held, duplicate forwarded to the stores ledger clerk.

The closest possible analysis of all stock is obtained by separating stores generally into three separate and distinct groups and dealing with them as such in the stores ledger.

Group 1—Raw material.
Group 2—Fittings, screws, nuts, bolts, etc. used in manufacture.
Group 3—Maintenance supplies (more or less fixed charges for stores required in the maintenance and upkeep of machinery used in production).

The mnemonic system can be used to advantage both for classification and location of stock. The chart explains the method of symbolisation.

The main types of stock are distinguished under divisions A to Y, each letter representing both a definite section of store area set aside for particular stock and the alphabetic arrangement in the stores ledger. The ledgers would thus be a complete representation of the stock ledger.

A section may consist of any number of rows or series of rows, depending upon the amount of stock in each division. Under main symbol F, for instance, as there are nuts, screws, bolts, staples, nails, etc., of all variety and size, with probably vari-sized bins, it might be necessary to have a subsymbol for each row; whilst, with other stock a row may consist of several subsymbols. There may, in the case of screws, be an aisle (two rows) or aisles allotted to them, one row solely for countersunk brass, another for countersunk steel, etc.

The rows may be designated SA, SB—A row for countersunk brass, B row for countersunk steel—making the system so far completely mnemonic: countersunk brass to be found in section F, symbol FSA. Sizes can either be added to the symbol, or the bin number added as location.

Such stock as steel, symbol S, consisting as it will of sheet, plate, and bar, would be best kept in a series of racks convenient to internal or external transport.

Costs and Production Standards—continued

STOCK SHEET

		A	B	C	D	E	F	G	H	L	M	N	P	R	S	T	V	W
A	Abrasives			Carborundum		Emery Wheel												
B	Brass, Bronze		Bars											Rods	Sheets			Wire
F	Fasteners (Nails, Nuts)		Bolts											Rivets	Screws			
G	Gaskets, Packing								Hemetite		Masonite							
H	Hangers, Brackets, etc.		Brackets shelf				Fasteners (sash)											
L	Lubricants, Paints							Grease									Varnish	
M	Machinery, Plant, Parts									Leather belting								
P	Pipes and Fittings		Bands, 1" B.&G.															
R	Rope, Hose, Belts, etc.		Belt lacing								Milling cutters			Rope				Wire
S	Steel	Angle Bar													Sheet			
T	Tools			Chucks Drills			Fixtures		Hammers					Reamers				
U	Maintenance Supplies																	
V	Timber																	
Z	Miscellaneous																	

Costs and Production Standards—continued

As over-accumulation of stock means tying up of capital which would perhaps be better applied to other uses, all ordering should be carried out systematically.

The quantity should be based on estimated requirements for a given period, plus a well-based reserve, depending, of course, upon available markets, economics of quantity-purchasing, depreciation, etc. The whole ordering programme should be so arranged as to keep delivery ahead of current requirements.

All possible contingencies must be considered to save interruption in delivery dates and ensure the prompt receipt of ordered stock; orders should be filed away and checked periodically.

Perfect control requires the specification in stock ledgers or cards of maximum or minimum reserves. When the danger point is reached, stock should be re-ordered. Ledgers should be designed to show stock on order, quantity ordered, and anticipated date of delivery.

For standard costs purposes, these ledgers should show receipts both at cost and standard; and for purposes of efficiency, co-ordination, and convenience, be under the direct control of the costs office.

The standard cost can be obtained by the use of a rubber stamp for use on invoices as received and checked. The impression could be:

Order No.:
Standard cost:
Variation—
Gain:
Loss:
Checked by:

Stock control cards, or ledger, preferably loose-leafed, should be kept in the stores room for entry of all receipts and issues, and as the foundation for a perpetual inventory system and reconciliation with the costs office ledger.

An effective running check between the two sets of records is thus always available, and when a continuous physical check is also the policy, no better system can be devised.

Factory orders and production sheets emanating from production control allow the storekeeper to retain a check on all requisitions received by him for stores. A requisition note signed by the foreman can be the authority for issue of material from stock and the basis for entry in the stores issued book, which should be kept in triplicate: two copies forwarded to stores ledger clerk and one retained for reference. One copy is held by stores department and one delivered priced to the costs clerk.

Stores returns, or transfers back to stock, will be recorded by the storekeeper in a stores received book, preferably of a different colour, and similarly treated.

(G) Stores: (ii) Ordering. — There should be a complete record in the stores department of all sources of supply, quotation, prices, freight charges, etc.

Purchasing requisitions, identifying the factory order and numbered, should be made out in triplicate, authorised and signed by some responsible officer: one copy to the storeman, one held in the purchasing department, and the original with the purchasing officer.

The purchase order should also be in triplicate: original to vendor, duplicate to receiving clerk for checking purposes, triplicate held by purchasing department.

On receipt of goods, delivery ticket is handed over and signed by receiving clerk as a record that goods were in fact received.

An entry of the delivery ticket, numbered, date of receipt, vendor, and stock received, is then entered in a delivery tickets register and the delivery ticket itself forwarded to head office for attachment to invoice when received.

On receipt of the invoice it should be priced, checked, numbered, and forwarded to the stock ledger clerk for entry.

When an order is received from an outside firm for manufacture of goods, same will be forwarded to production control, whence factory order authorising production and production requisition for purchase of raw material, when necessary, will issue.

(H) Plant Department. — Plant or works engineer is responsible for the maintenance, running order, parts necessary for repair work, systematic arranging of material for repairs, and the efficiency of the whole plant.

(I) Research and Experimental. — This department can carry out work on trial batches for the planning department, make experimental tools and apparatus as a result of suggestions of members of the staff, etc., and carry out research generally.

Costs and Production Standards—continued

(J) TOOL ROOM.—Under the control of this department comes the making and maintenance of all tools, jigs, fixtures, gauges, templates, etc. in order that production be maintained at maximum efficiency. A new type of production may necessitate the making of special tools and appliances, and this is a job for the tool room.

Tools must be kept at the highest degree of efficiency, and, upon completion of a job, tools retained should be immediately sharpened and made ready for further service.

The tool room should be so arranged that all tools are easily accessible to the workmen. When instruction sheets issued from the planning department are also part of the production programme, there can be no fear of wrong tools being used in operations. The correct type will be specified on the sheets.

Easy accessibility is possible where a system of symbolism is allied with group and type classification; all groups being segregated, allocated a mnemonic symbol, and again subdivided into classes. Groups could be as follows:—

(a) Abrading tools
(b) Blanking tools
(c) Clamps and holders
(d) Drilling and boring tools
(h) Hammers, chisels, etc.
(j) Jigs, fixtures, etc.
(m) Measuring tools
(p) Paring tools
(r) Revolving cutters
(s) Slotting tools
(w) Wrenches
(z) Miscellaneous

The principle may be exemplified in the caliper gauge, of which there are many types.

It is a measuring device, therefore the group symbol is M.

It is a gauge; symbol MG.

Style, caliper; symbol MGC.

There are many types of caliper gauge, amongst them: (1) progressive limit, (2) taper plug, (3) adjustable limit snap, (4) double-ended snaps. (1) and (2) are internal; symbol MGCI. (3) and (4) are external; symbol MGCE.

The full symbolism is: (1) MGCILP, (2) MGCIPT, (3) MGCELSA, (4) MGCESDE.

Size and symbols should be clearly marked on all tools.

A key book kept in the tool room will allow of all tools being easily obtainable. Thus, with all aisles or location plainly lettered as to group, type, and subdivision etc., and bins similarly described, there can be no possibility of error. The question as to whether tools will be manufactured or purchased will depend upon cost, the requirement of the particular industry, and the economics of production.

(K) CANTEEN AND WELFARE.—Showers, lighting, rest periods, canteen service, and all matters concerning the welfare of the employee will be well repaid by willing workmen and better production. It is a matter which should receive close attention.

THE AUSTRALASIAN INSTITUTE OF COST ACCOUNTANTS

SEPTEMBER 1950 EXAMINATIONS

EXAMINER'S REPORT ON FINAL COSTING—SECOND PAPER

Following is an analysis of the marks obtained by the 135 candidates who submitted answers to this paper:

Under 45 marks ..	8	
45-54 marks	13	
54-59 „	12	
60-64 „	14	
	—	47
65-69 „	18	
70-74 „	16	
75-79 „	24	
80 and over	30	
	—	88
		135

It will be seen that one-third of the candidates failed to reach pass standard in what most candidates found to be a relatively easy paper.

The average percentage of marks obtained for each question and the number of candidates who were passed in each question were as follows:

Question No.	*Marks Allotted*	*Average Marks Obtained*	*No. of Candidates Awarded a Pass*
1	30	16.98	63
2	15	10.83	108
3	20	16.39	125
4	15	11.50	114
5	20	12.67	80
Full paper	100	68.37	88

QUESTION 1 asked for a statement which would provide the manager with maximum information on factory efficiency. Many students lost marks by presenting as their answer:

(a) a confusing mass of figures, some or all of which may have been correct, but which certainly was not a statement one should submit to a manager; or

(b) journal entries and/or ledger accounts, neither of which was asked for, and which do not constitute a statement to a manager.

In many cases candidates also did not clearly indicate whether a variance was a loss or gain—this was apparently left for the manager to decide for himself. Most candidates had little trouble calculating the variances on labour and expense, but many experienced difficulty in distinguishing the losses due to material price variation from those caused by usage or consumption.

Most candidates found this question the most difficult one in the whole paper.

QUESTION 2

The principal fault in answers to question No. 2, which dealt with the treatment of sick and holiday pay in the preparation of monthly profit and loss statements, was the failure on the part of many candidates to illustrate their answer with examples, as the question required. In addition, some candidates did not read the question carefully, and answered it from the aspect of determining product costs instead of the preparation of monthly profit and loss statements. There is no need for candidates in questions of this type to waste time in explaining what sick and holiday pay is.

QUESTION 3

This question dealt with:

(a) the entries in a cost ledger under a job cost system; and

(b) the preparation of a statement showing the results for the month.

On the whole this question was well answered, but a surprising number of candidates forgot to answer part (b). Chief defects were that many candidates omitted to complete the double-entry when entering all transactions (including opening stocks) in the cost ledger; sales and unabsorbed expense were transferred to the cost of sales account; and the gross profit brought down as a balance on the cost of sales account.

Examiner's Report on Final Costing—continued

QUESTION 4, which dealt with machine hour rates, was poorly answered; candidates were not asked "What are advantages of a machine hour rate?" or "When should a machine hour rate be used?" No marks were earned for covering these points.

Many candidates did not appreciate that machine hour rates may be either predetermined or historical, and are not applicable only to job costing. The examples were, on the whole, disappointing, or were omitted altogether. Many examples failed to show how the amount of each item would be determined; others showed only a list of expenses, without showing how a rate is obtained. Whilst most candidates knew what a machine hour rate was, and how it was calculated, nearly all lost marks through not giving a complete answer.

QUESTION 5 asked for a report for the information of the general manager interpreting a statement of results for the month as compared with budget figures. Many reports were badly written and would antagonise the general manager and any other executive to whom they were referred. Some answers revealed a lack of knowledge of standard costs. Increased cost of production during the month does not account for a reduced gross profit, but would be reflected in the variations from standard.

"Wrong standards" is a very poor answer to give for all variations from standard. Many candidates appear to believe that under-recovered expense is caused solely by inefficient labour, without recognising that the labour may be efficient, but not sufficient in volume. Nor is under-absorbed expense necessarily the result of increased labour efficiency.

In comparing the results for the month with the budget for the month, many candidates failed to draw attention to the decreased rate of standard gross profit earned as compared with the budget rate.

On the whole, this question was not handled well.

Conclusion

The poor results achieved in Questions 1 and 5 appear to indicate that students have insufficient knowledge of standard costs. More attention should be paid to the presentation of information and reports. Care should be taken also to read the questions carefully and supply the information asked for. Many candidates apparently spent too much time on questions carrying low marks and left themselves insufficient time for the more important questions.

EXAMINER'S REPORT ON FINAL COSTING — THIRD PAPER

Average marks obtained by candidates were 60.3%, which would pre-suppose that more than 33% of candidates gained pass marks (65 or more). The result, however, was due to lack of consistency in the work of candidates over individual questions. As the paper was neither too long nor too difficult, it can only be assumed that candidates lacked general grounding in the subject.

Marks ranged from as low as 17% (in this case the candidate answered only two questions) to 83%. Average marks and average percentages relating thereto for each question were as follows:

Question:	*1*	*2*	*3*	*4*	*5*	*Total*
Marks possible	20	20	20	20	20	100
Average marks obtained	13.3	12.1	13.4	9.4	12.1	60.3
= Average %	66.5	60.5	67.0	47.0	60.5	60.3

The percentage of passes in each question was as follows:

Question:	*1*	*2*	*3*	*4*	*5*	*Total*
Pass %	74	44	67	23	48	33

Question 1 obviously presented least difficulty to candidates, while Question 4 secured the smallest number of passes and averaged less than 50% of the possible marks.

The following table shows the range of marks obtained for each question, expressed as a percentage of candidates sitting for the examination.

Examiner's Report on Final Costing—continued

PERCENTAGE OF CANDIDATES

Question:	*1*	*2*	*3*	*4*	*5*	*Total*
Under 50	4	12	7	42	10	10
50-54 ..	3	10	1	13	10	11
55-59 ..	6	9	7	8	12	21
60-64 ..	13	25	18	14	20	25
65-69 ..	23	18	14	12	23	23
70-74 ..	25	10	21	4	14	7
75 & over	26	16	32	7	11	3
	100	100	100	100	100	100

The high standard achieved in some questions, as indicated by the percentage gaining 70 or over, was obviously not maintained throughout the paper by the candidates concerned, as only 10% reached this mark over the whole paper.

QUESTION 1

Several candidates in this question limited their answer to the preparation of the budgeted cost of production, whereas the physical requirements based on specifications of the products require prior consideration.

The production budget, when approved, becomes the master production plan on which all activities are co-ordinated, these including scheduling to departments and call-up of labour and materials as required. Candidates in several cases limited explanation of the functions of the production budget to its value in scheduling production, omitting its use in the call-up of labour and release of materials, etc.

QUESTION 2

A number of candidates appeared to be uncertain of the meaning of the term "cost centre," assuming that a cost office is located at this point in production. This reasoning may be upset by the establishment of a number of similar machines at different points in the factory as a "cost centre."

Most candidates dealt satisfactorily with the special points involved in the different types of production, although due emphasis was not given to the separation of operations under job costs and the stages in production where output could be measured under process and continuous assembly production.

QUESTION 3

The flow chart showing the method of recording and posting labour costs under a job cost system was generally drawn up very well, some candidates gaining full marks.

While some candidates illustrated a separate flow from the payroll and analysis to control accounts and from time sheets and summary to job cost sheets, it is preferable to portray the analysis of the payroll through time sheets, the detail then being posted to cost sheets while totals are posted to work in progress and expense accounts. Candidates who failed in this question either presented an untidy flow chart or omitted vital labour cost records or accounts.

QUESTION 4

Very few candidates answered this question well, some even finding nothing to criticise in the method of allocation of overhead or calculation of break-even point.

The assumption that overhead is likely to remain at the average level for the preceding three months for the reduced sales figure calculated at a break-even point is faulty, in that overhead is very unlikely to remain entirely fixed for varying levels of sales.

It is inadvisable to allocate overhead, as between products, on sales figures. In the absence of further information it would be preferable, subject to the undermentioned comment, to allocate overhead on the basis of cost.

A number of candidates incorrectly interpreted total sales for the preceding three months as sales at list price, the figures for which would certainly not be obtainable from the firm's accounts, as all sales would be entered at net figures, i.e. after deduction of the appropriate trade discounts. This interpretation was based by them on the incorrect gross profit percentages which had been calculated on list price and not net sales figures.

Many candidates drew attention to this incorrect calculation and showed the correct percentages as: class "A", 28⁴/₇%; class "B", 37½%; and class "C", 44⁴/₉%. Irrespective of the basis of overhead allocation, this correction naturally affected the calculation of the break-even point.

(Continued on page 151)

Examiner's Report on Final Costing—continued

Cost itself will doubtless vary, particularly in regard to the overhead content, which is unlikely to remain strictly variable with production or procurement. This will have the effect of varying the gross profit percentage, which has been based on a standard cost for the purpose of fixing list prices.

Finally, as it is unlikely that the same ratio of sales as between products for the preceding three months will be maintained, it is inadvisable to use this ratio for calculation of the break-even point. The latter should be calculated by means of a graph for total sales only, after the preparation of the necessary budgets, including the separation of fixed overhead from variable overhead at the budgeted sales level.

QUESTION 5

This question should have gained a higher average mark than 60%, with only 48% of passes.

The preparation of the expense budget, separated into fixed and variable expense for the budgeted production level, with allocation of service departments' expense to productive departments and with further allocation to cost centres, would provide a basis for the establishment of cost centre rates applicable to the standard operations through which the product passes.

BOOK REVIEWS

Cost Accounting and Analysis: CARL THOMAS DEVINE, PH.D.; The Macmillan Company, New York, 1950. Pp. 752, price $5.

This is a new book, first printed and published in 1950, and is, in the author's own words, the result of many years of experimentation in the teaching of cost accounting to undergraduate and graduate students. This is quite evident from the thorough manner in which the various topics are handled.

The work is divided into three sections, the first discussing the mechanics of cost compilation, the second covering the accounting techniques used in cost control, and the third dealing with the problems of profit planning and the calculations necessary for budget construction.

Section I (Mechanics), after a preliminary discussion on general accounting and cost accounting, introduces the elements of manufacturing accounting and departmentalisation, and then proceeds to deal fully with process costs, joint product costs, and finally with job costs. The latter subject is dealt with firstly on a purely historical cost basis, and then estimated expense allocation is introduced and explained.

Section II (Control) is opened by a general discussion on system design, and then develops into detailed discussions and illustrations of methods and records of purchasing, receiving, and vouchering; materials costing and control; pricing; labour costing, control, and wages calculations; standard costing (including basic standards); and concludes with a chapter on the control of distribution costs.

Section III (Profit Planning) opens with a discussion on the variations of the concept of cost, and proceeds to deal with profit planning, covering such matters as fixed and variable costs, factor combination, selection of plant, and plant shutdown and abandonment. Then follows a chapter on selling cost analysis, one on costs and pricing policy, and the work concludes with a discussion on uniform costing and ethical matters.

Although this book is divided into the three sections described, it is a well-integrated, complete work. Each section develops in logical steps to be complete in itself, while remaining within the framework of the overall plan of the work which is described in its title.

Throughout it is copiously illustrated with sample problems and solutions, charts, and forms, and, for student use in particular, there are numerous problems given at the end of each chapter.

This is a text which is recommended to student and practitioner alike.

L. H. DILLON.

LEGAL SECTION

Edited by

J. M. GREENWOOD, LL.B., F.I.C.A.

COMPANY LAW: POWER OF A COMPANY REGISTERED UNDER A FORMER ACT TO CHANGE ITS NAME

The Ballarat Trustees, Executors & Agency Co. Ltd. was incorporated and registered under the Companies Statute 1864 (Vic.). By extraordinary resolution it purported to change its name to The Fidelity Trustee Co. Ltd. The resolution was approved by the Governor in Council on 28 March, 1950, and on 31 March, 1950, a new certificate of incorporation was issued by the Registrar-General. Section 19 of the Companies Act 1938 (Vic.) gives power for a company to change its name and "company" by definition in s. 3 means a company registered under Part 1 of the 1938 Act or an "existing company." "Existing company" is defined in s. 3 as "a company formed and registered under Part 1 of the Companies Act 1928 or under Part 1 of the Companies Act 1915 or under the Companies Act 1910 or under or subject to Part 1 of the Companies Act 1890."

A question arose as to whether the company had power to change its name not having been "formed and registered" "under or subject to" any of the Acts mentioned.

Sholl, J., before whom the case was heard, stated: "The question turns on the application of s. 316 to s. 19, and on the definition of 'existing company' in s. 3 of the Act. On an examination of the history of the Victorian companies legislation which has been very thoroughly presented to me by counsel, I have arrived at the conclusion that that definition should be construed with a meaning quite different from that which one would adopt on an ordinary reading of it. The meaning which appears at first sight is that which relates the words 'under or subject to Part 1 of the Companies Act 1890' to the participles 'formed and registered'. It then becomes very difficult to apply the definition to companies formed and registered under the Companies Statute 1864. I prefer to adopt the submission by Mr. Tait that the true explanation of the definition is that it represents a series of successive expansions of the original definition in the Companies Act 1910. The Companies Act of 1896 defined a company as 'any company incorporated under or subject to Part 1 of the Principal Act (i.e., the Companies Act 1890) or Division 1 or Division 111 of this Act', the expressions 'incorporated under' or 'subject to' being clearly alternatives.

"In the Act of 1910 an 'existing company' is defined as 'a company formed and registered under or subject to Part 1 of the Companies Act 1890'.

"The words 'formed and registered under or subject to' are in the same relation to the noun 'company' as the words 'incorporated under or subject to' were in the 1896 Act. However, in the 1915 Act the definition of 'company' said 'a company formed and registered under this Part or under the Companies Act 1910 or under or subject to Part 1 of the Companies Act 1890'. Obviously 'subject' was still intended to be an adjective qualifying the noun 'company'.

"This was the commencement of the unbalance which was continued and exaggerated in subsequent definitions in the 1928 and 1938 Acts.

"The history of the legislation, therefore, when looked at as a whole, indicates that the definition in the 1938 Act should be read:

" 'Existing company' means a company:

(*a*) formed and registered—
  (i) under Part 1 of the Companies Act 1928, or
  (ii) under Part 1 of the Companies Act 1915, or
  (iii) under the Companies Act 1910, or
  (iv) under Part 1 of the Companies Act 1890, or

(*b*) subject to Part 1 of the Companies Act 1890.

"This is the only way in which the definition can give effect to what was obviously the intention of successive draftsmen, though, as I say, it is not the meaning

Legal Section—continued

one would give to it on ordinary principles of grammatical construction.

"The next question is whether this company, which was incorporated and registered under the Companies Act 1864, was subject to Part 1 of the Companies Act 1890.

"Section 32 of the Acts Interpretation Act 1890 provided that the consolidating Acts enumerated in the Second Schedule to that Act should apply to the persons, things, and circumstances appointed or created by and existing or continuing under the corresponding Acts repealed thereby. The Companies Act 1890 is one of such consolidating Acts enumerated in the Second Schedule, and 'person', by the definition in s. 5 of the Acts Interpretation Act, includes a corporation.

"Section 2 of the Companies Act 1890 repealed the 1864 Companies Statute, and so, by virtue of s. 32 of the Acts Interpretation Act 1890, the Companies Act 1890 applied to the applicant company. Therefore the applicant company is a company subject to Part 1 of the Companies Act 1890. It has accordingly, power under s. 19 of the Companies Act 1938 to change its name." (*In re Thomas, dec'd*, [1950] V.L.R. 289.)

PATENTS: WHAT CONSTITUTES "SUBJECT MATTER" AND "INVENTION"

Where an apparatus has been the subject of a grant of letters patent, validity of the patent may be challenged on the ground of want of subject-matter. Subject-matter has five requirements: (a) that the invention is a manufacture; (b) that it is not obvious to those skilled in the art and acquainted with the common knowledge of the art at the date of the patent; (c) that it has not been previously published or used; (d) that it is useful in the sense that it possesses an advantage over existing knowledge; (e) that no valid patent has previously been granted for it.

It is a question of fact in any given case whether an invention exists or not, and the amount of ingenuity exercised in the invention is immaterial if there be some exercise of the inventive faculty.

"A distinguished English scientist (Dr. H. Stafford Hatfield, discussing the question 'What is invention?', refers to 'this mysterious element of invention', and observes: 'The law has been compelled to assume the existence of a special faculty, which nevertheless cannot be proved to exist either by an examination of its supposed possessor, or by an objective test of the product. The more this special faculty is examined the more elusive and mysterious it appears.' (*The Inventor and His World*, chapter 1, pp. 13-14). In *Samuel Parkes & Co. Ltd.* v. *Cocker Bros. Ltd.* (1929), 46 R.P.C. 241, at p. 248, Tomlin, J., said: 'Nobody . . . has told me, and I do not suppose anybody ever will tell me, what is the precise characteristic or quality the presence of which distinguishes invention from a workshop improvement. Day is day and night is night, but who shall tell where day ends or night begins?'

"Dr. Fox narrates how the defence of lack of subject-matter, in the sense of the inventive act being of insufficient quality, came to be part of the law of patents, and he demonstrates how fruitless have been all attempts to define this concept (*op. cit.*, at pp. 165 *et seq.*).

"The judicial process undertaken to decide whether invention is present involves two steps: the first, a determination whether the evidence establishes that the alleged inventor has found out something which had not been found out by somebody else; the second, undertaken if the first is determined affirmatively, a decision whether what has been found out is sufficiently removed from what is obvious and from common knowledge that it is proper to give to the inventor the monopoly that upholding the validity of the patent will confer. The second step involves what Dr. Fox calls 'a judgment based entirely upon value—on the feelings and prejudices of the judge who is called on to decide the issue' (*op. cit.*, p. 182); an idea expressed by Terrell (*op. cit.*, p. 65) in the passage 'the question to be decided is whether there is sufficient "*quantum* of invention" in the step taken by the inventor to warrant the grant of monopoly rights. The decisions are therefore really decisions of feeling—each judge viewing the invention against

Legal Section—continued

the background of his own experience.' ''

The above is extracted from the judgment of Barry, J., in *Camp* v. *Amalgamated Photo-Finish Pty. Ltd.*, [1950] V.L.R. 213.

PATENTS: THE PHOTO-FINISH

The judgment of Barry, J., in *Camp* v. *Amalgamated Photo-Finish Pty. Ltd.*, [1950] V.L.R. 213, an action for infringement of letters patent for ''apparatus for photographing the finishes of horse races and the like,'' contains some facts about horse racing which may not be known even to the regulars.

At the finish of a race the leading horses are travelling at about 37 miles an hour, or approximately 660 inches a second. A photograph taken of this by a ''still'' film or plate would be inaccurate unless the operator made the exposure at precisely the right moment. If a camera automatically took 10 ''frames'' a second, one photograph might show the horse 9 feet from the finishing line and the next 9 feet past. At 75 ''frames'' there would be about 6 inches between one image and the next; at 170-180 ''frames'' a second the distance travelled between photographs would be about 3½ inches.

About 1939 what is known as the continuous-flow camera was used in U.S.A. to record finishes. The process is described as follows:

''The camera is secured and locked into a surveyed position in the winning plane of the race track. Its field of view in the vertical plane is sufficient to cover the entire width of the track from inner to outer rails.

''Behind the lens of the camera and immediately in front of the film is a vertical slit, of such a width and so aligned that the image of the winning line falls within it. The entire horizontal field of view of the camera is thus reduced to the immediate vicinity of the winning line alone.

''Behind the slit the film is caused to travel smoothly in horizontal motion, at such a speed so that when the horses pass across the winning line (and their images in turn pass the slit in opposite direction), these moving images synchronise with the movement of the film.

''Since the camera can see nothing but the winning line and objects in the winning plane, the images are recorded on the moving film in the order in which they pass the winning line.

''Because the film is synchronised with the images the resulting pictures are clear and sharp, and it is only necessary to run the camera long enough, to record, on one continuous graph, the passage of the entire field, should this be necessary.

''The record obtained thus represents a graph, in terms of time, of the order of passage of a number of objects past a fixed point.''

In one finish thus recorded the winning horse reached the finishing line approximately one thousandth of a second before the second horse, which meant that at that moment of time the distance separating the two horses was two-thirds of an inch.

WILLS: OMISSION OF WORDS FROM PROBATE COPY

''I do not desire the presence of my wife at my funeral or near me when I am dead as she has been unfaithful. . . .'' Application made by the widow to have these words deleted from the copy of the will annexed to the letters of administration was granted by the Victorian Supreme Court in *Re N.*, [1950] V.L.R. 139. Sholl, J., in the course of his judgment surveyed the authorities on this branch of the law, and extracted the following principles:

(1) Words will not be struck out of the will itself.

Authorities cited in support of (1)

Curtis v. *Curtis*, [1825] 3 Add. 33 — application refused to strike out of a will, ''I leave all my property of every kind to my sister Mary in consequence of the cruel and murderous conduct of my wife in this illness as well as in past instances.'' In the *Estate of White*, [1914] P. 53—order made for the exclusion from probate copy but not from the will itself of words scandalous and defamatory to widow.

Re Maxwell dec'd., [1929] 45 T.L.R. 215, similar order made. To a suggestion that

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anyone could learn the contents by search at Somerset House, Hill, J., replied that anyone who published the contents would expose himself to an action for libel or slander. Sholl, J., stated that in such cases the Victorian Registrar does not make the will itself available on search except by direction of the Court.

(2) If the words complained of are scandalous and offensive and non-dispository in their nature (in the sense that they dispose of no property), and are not inserted as an alleged reason for making or not making certain dispositive provisions, the Court may exclude them from the probate.

Authorities cited in support of (2)

In the Goods of Wartnaby, [1846] 1 Rob. Ecc. 423—application granted for the exclusion from probate copy of two passages constituting an "atrocious libel" on a mere stranger unconnected with the testamentary disposition of the deceased.

Marsh v. *Marsh,* [1860] 1 S. & T. 528—certain expressions deleted from probate copy which were "derogatory to the Roscoe family." In the *Estate of Caie,* [1927] 43 T.L.R. 697—the Court refused to exclude clauses in which the testator stated the age at which he would like his children to choose the Christian body to which they would belong and exhorted certain persons to become freemasons. There was found to be no reflection on any individual.

In the Goods of Honeywood, [1871] L.R. 2 P. & D. 251—Application rejected for the exclusion of a request that a record of certain legal proceedings should be handed down in the family as evidence of the fraud of the testator's sister-in-law. Sholl, J., explains this as being a decision that the words complained of were not within this particular rule. It may be, however, that it falls more aptly within rule (7) below.

(3) If the words complained of are scandalous and offensive, and non-dispository in their nature (in the sense that they dispose of no property), but state the testator's reasons for making or not making certain dispositions, then, at all events if there is *prima facie* evidence before the Court of their untruth, the Court may omit them—see *In the Estate of White*—and probably if they are scandalous and offensive as being libellous of an individual, even without specific evidence of their untruth being placed before the Court, the Court may omit them.

Authorities cited in support of (3)

In the Estate of Hall, [1943] 2 All E.R. 159—in response to an application by a person named in the codicil to strike out certain words alleged to be scandalous and defamatory and injurious to his reputation, Bucknill, J., would only allow four words to be struck out, being the only words which in his opinion might be regarded as defamatory.

Re B. dec'd (1947) (decision of Victorian Supreme Court, unreported), application granted for the exclusion of words explaining that "I have only made the beforementioned bequest to my wife as I do not believe she has been a true and faithful wife . . ." and "I am leaving nothing to X as my wife has indicated to me she is not my daughter. . . ."

Re O'Reilly, [1927] V.L.R. 533—application refused for the exclusion of the words, "I make no provision for my wife . . . on account of her intemperate habits and other misconduct." Sholl, J., in commenting on this case, which at first sight runs counter to the rule, pointed out that Lowe, J., had subscribed to the principles that the words to be omitted must be scandalous or defamatory and "in no way germane to the dispositions of the will." Evidently the words used were not sufficiently strong to be scandalous or defamatory or were germane to other provisions of the will.

(4) If the words are merely offensive to the testator's family in relation to the disposal of the testator's body and are non-dispositive as regards property, the Court may omit them.

Authorities cited in support of (4)

In the Goods of Bowker, [1932] P. 93—Order made excluding from probate directions as to the disposal of the remains and the funeral which were offensive to members of the family though they made no allusion to any individual.

(5) If the words are blasphemous, and non-dispositive as regards property, there is some authority that they may be omitted.

Authorities cited in support of (5)

For: *Tristram & Coote's Probate Practice,* 18th edn., at p. 40.

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Possibly against: *In the Estate of Caie, supra.*

(6) If the words are non-dispositive and such as in time of war, considerations of national security render it undesirable to publish, the Court may omit them. Possibly this may extend to a similar exclusion in peacetime.

Authority cited in support of (6)

In the Goods of Heywood, [1916] P. 47 —Portion of a military will was excluded on the application of the military authorities.

(7) If the words may have some dispository effect, or assist as a matter of construction in the interpretation of actual dispository provisions, the Court may decline to expunge them.

Authority cited in support of (7)

In the Estate of Rawlings (1934), 78 Sol. Jo. 338—Testator gave W. certain assets on condition that she did not have anything to do with "that rascal, her husband or any of his family, except C., her son." It was held that these words ought not to be excluded, as they might assist the Court in construing the condition of which they formed part. They were in fact part of a dispositive expression.

Concluding, His Honour said: "I can see no reason why the Court should be astute to assist the testator to utter from the grave and to publish to the world, with the authority of the Court and with an authority which fate denied him in his lifetime, allegations of an offensive and injurious character which it might be difficult or impossible for the subject of them adequately or effectually, after the testator's death, to refute."

STUDENTS' SECTION

Edited by

K. C. KEOWN, A.I.C.A., A.M.T.C.

SOME LEGAL ASPECTS OF SHARE CAPITAL

by

ALAN MANN

Accountancy students will be quite familiar with the distinction to be drawn between Capital and Income. In connection with Companies, however, we must be prepared to find the word "Capital" used in a variety of different senses and sometimes in a context which is misleading. There is no need for any confusion in this matter, and the best way to avoid it is to have a clear picture of the financial structure of Companies, and to use the correct terms when referring to the various classes of moneys that can be described as Capital.

Nominal Capital

In Companies where the liability is limited by shares, the Share Capital must be nominated at the time of registration of the Company, since the liability of the members is one of the things that must be shown in the Memorandum. The members who sign the Memorandum may agree to take only one share each if they so desire, and so the promoters usually estimate the probable requirements of the Company and capital moneys, and nominate a figure which they think will cover these requirements. This figure is the Nominal Capital of the Company, and the Company may from time to time receive applications and allot shares up to the full amount of the Nominal Capital. However, the shareholder is only liable for the shares he has agreed to take. Where it is found that the Nominal Capital is insufficient, it will be necessary for the Company to increase its Nominal Capital so that more shares will be available for allotment.

Issued Capital

The Nominal Capital does not represent an asset or a liability of the Company, it is simply an estimate or a target mentioned in the Memorandum. The Issued

Students' Section—continued

Share Capital, on the other hand, represents an asset of the Company until the shares are paid for when it represents a liability for the Company, or in other words imposes on the Company an ultimate liability to repay the paid-up capital in the event of Winding Up. The Issued Capital of the Company may be increased at any time up to the limit of the Nominated or Nominal Capital, by the issue of new shares.

Increase in Capital

The Capital of the Company may be increased in two ways:—
First, if the Company has some of its Nominal Capital unissued, it may increase its actual issued capital by issuing fresh shares. In a second sense the Capital of the Company may be increased by altering the amount of the Nominal Capital.

The first type of increase may be achieved by the Company at any time, since it cannot harm any creditors or other persons interested in the Company, and it does not involve any change in the Memorandum. Where, however, the Nominal Capital is found to be insufficient and requires to be increased, any alteration will involve altering the Memorandum, and the Memorandum cannot be altered unless the Act specifically authorizes the alteration to be effected. Since, however, an alteration in the Nominal Capital does not affect the rights or liabilities of any persons or prejudice the Company in any way, we would expect to find a provision in the Act enabling this alteration to be effected quite readily. It is provided in s. 51 of the Victorian Act that a Company limited by shares may, if so authorized by its Articles, alter the conditions of its Memorandum to effect the variations in the Capital of the Company referred to in that section. These variations include an increase in the Registered or Nominal Capital. There is no need to apply to the Court, and if the Articles do not already permit the increase, or if the Company has no Articles, then the required authority by its Articles may be effected by a Special Resolution without any need to approach the Court.

Alterations to Capital

The same section permits certain other alterations, including the re-arrangement of share parcels or values by consolidating the Share Capital and subdividing it again into shares of a different value. Similarly, fully paid-up shares may be converted into stock and re-converted into shares of any denomination, or any of the shares may be subdivided into shares of smaller value. None of these provisions affect the total value of the Company's Capital, either issued or otherwise, nor do they alter the total value of any person's share and so, although these provisions relate to issued as well as to Nominal Capital, they do not affect the rights or liabilities of any person, and so they are included in the provisions of s. 51 which enables them to be effected quite readily.

Cancellation of Shares

The expression "cancellation" is used purposely to avoid confusion with the word "reduction" as applied to Share Capital, and it is important to bear the distinction in mind. Cancellation refers only to unissued Share Capital, and the alteration involves reducing the unissued Nominal Capital when the original estimate set out in the Memorandum has been found to be unnecessarily high. Here, again, the alteration to the Memorandum required to cancel these unwanted shares is included in s. 51.

The powers conferred by s. 51 may be exercised by the Company in General Meeting and a Special Resolution is not required. An Ordinary Resolution is sufficient.

Reduction of Share Capital

This process applies to the Share Capital which has actually been issued, and does not apply to the Nominal Capital of the Company. The reduction can be achieved in a variety of ways, but, since it will vitally affect the interests of the parties concerned, a Special Resolution is required and the Company must obtain the confirmation of the Court, in addition to having the authority set out in its Articles. Three methods of reducing Issued Share Capital are set out in the Act in s. 55:—

(*a*) By extinguishing or reducing the liability on any of its shares in respect of Share Capital not paid-up. This applies to shares actually issued to persons who have agreed to pay for them, and so their liability to

Students' Section—continued

the Company represents one of the Company's assets. If the liability is extinguished or reduced, the Company's creditors will be vitally concerned and the application to the Court will protect their interests if there are any creditors.

(*b*) Cancel and paid-up Share Capital which is lost or un-represented by available assets.

The chief effect of this course will be to make the Company's Balance Sheet look better. By reducing the Capital liability to shareholders to a level in keeping with the Company's assets, the Company's financial position will be improved considerably. The creditors will not be greatly concerned because this process does not involve releasing any assets or repaying any money. It may, however, be of further benefit to the shareholder since, if the Company has made heavy losses over a period of years, but, having weathered the storm, finds that it can carry on business profitably, the reduction of the liability for Share Capital will enable the Company to devote its future profits towards the payment of dividends instead of applying it towards the repayment of capital losses.

(*c*) Paying off any paid-up Share Capital which is in excess of the wants of the Company.

Here, again, the creditors of the Company will be directly concerned, because if there are any creditors they will desire to be paid before the shareholders receive any of their capital back.

Debenture Capital

The foregoing provisions relating to Share Capital apply to moneys paid by a member in his capacity as a shareholder to his Company. The terms of payment are largely governed by the Memorandum and Articles as are the rights which he receives in exchange for his payment, e.g. his voting power will usually depend upon the amount of his shareholdings. In many ways the share capital held by a member of a Company is an index to his rights. Debenture Capital on the other hand involves no such relationship. A debenture holder is not a member of the Company, but is merely a creditor of a specially favoured class. The very word "debenture" means much the same thing as the word "debit note," and is simply an acknowledgment of the debt. The debenture may or may not be charged or secured on the Company's property. If it is, it will require to be registered as a charge. This gives the holder, or the trustees appointed to act for him, special powers over the Company's property, but the rights gained by registration as a charge are quite different from the rights of a shareholder.

A debenture holder is entitled to repayment of his money as a debt, and if interest is provided for he is entitled to this also. The interest will be payable at a fixed rate, and the debenture holder will not be entitled to share in the profits of the Company.

Despite the fact that the debenture holder is not in any sense a member of the Company, he is, as a creditor, interested in the financial progress of the Company, and so the Act makes provision to enable the debenture holder to keep in touch with the Company's affairs. Further provisions are designed to disclose the existence of debentures, and so we find provisions requiring debenture holders to be registered in much the same manner as shareholders and giving debenture-holders rights to information as to the Company's financial position which are, broadly, similar to some of the rights enjoyed by shareholders. The similarity of pattern, however, must not be allowed to lead to confusion.

REGISTER OF MEMBERS

COMMONWEALTH INSTITUTE OF ACCOUNTANTS

VICTORIA

Admitted as Associates:
Messrs. H. S. Chalkley, H. J. Puddy.

Advanced to Fellow:
Mr. W. B. P. Ashby.

(The above Admissions and Advancements were approved by General Council through Rotary Resolution. The Council of the Victorian Division has not met to approve Admissions for Membership since publication of the last issue.)

NEW SOUTH WALES

Admitted as Provisional Associates:
Miss N. E. Loder and Messrs. V. L. Abbott, J. F. Baker, J. D. Fraser, D. H. Gotz, E. C. Grainger, D. B. Green, R. N. Hammond, D. N. Harvey, W. H. Haslem, L. B. Holgate, L. J. Howison, G. C. Jones, N. B. Kerslake, H. A. Koppstein, E. J. Lane, L. J. Logue, H. J. Lunney, A. Macleod, J. G. R. Manion, D. S. Morgan, H. D. B. McGranger, R. F. McKenzie, T. E. Osborn, N. A. Phillips, A. L. Taylor, K. H. Taylor, N. M. Thomas.

Admitted as Associates:
Messrs. G. J. Balfour, J. E. Chambers, W. E. Copp, J. Cragga, J. Cummings, R. G. Davies, K. J. Ennever, S. V. Folkes, A. D. Friend, G. A. Harvey, A. C. Lackey, V. S. Lawrie, J. L. Merrotsy, R. M. Murden, P. L. Waterfield, R. W. Webb, B. U. Williams.

Advanced to Associate:
Mr. C. A. Wheeler.

Advanced to Fellow:
Messrs. E. R. Alchin, H. G. Carruthers.

Names Removed from Register:
Messrs. G. O. Dewey, J. S. Johnson, C. F. A. Moore (all deceased).

QUEENSLAND

Admitted as Provisional Associates:
Messrs. K. J. F. Gaulton, A. J. Paulson.

Admitted as Associates:
Messrs. A. M. Hall, T. L. Short.

Advanced to Associate:
Messrs. J. H. Cory, F. Popper, R. W. Stewart, A. R. Thorburn.

Names Removed from Register:
Messrs. R. F. Daniel, H. Rowton (both resigned).

SOUTH AUSTRALIA

Admitted as Associates:
Messrs. K. A. Davies, B. H. Kingsborough, A. R. Tabe.

Names Removed from Register:
Mr. J. G. N. Wauchope (deceased), and Mr. F. E. White (resigned).

TASMANIA

Admitted as Provisional Associates:
Messrs. B. L. Groom, S. F. McDermott.

AUSTRALASIAN INSTITUTE OF COST ACCOUNTANTS

Admitted as Associates:
Messrs. D. L. Elsworth, K. L. Hubble, and A. E. Mannix.

Admitted as Provisional Associates:
Messrs. W. H. Collins, R. R. Crozier, K. F. Delaney, L. H. L. Dixon, and G. J. Rogers.

Advancements from Provisional Associate to Associate:
Messrs. A. T. Muller and W. H. Weekes.

End Pages

by

Angus Lancaster

SHALL AND WILL

I have a friend, Lt.-Col. C. H. Jones, C.M.G., a former Housemaster of Uppingham, England. Although 86 years of age, the Colonel is in the best of health except that he is nearly blind.

My dear friend is a combination of Colonel Newcomb and Mr. Chips. He has that downright goodness and warm humanity we associate with both these beloved heroes. In the categories of Robert Graves he is a good man with a golden heart. The Colonel has the courage, manly bearing, and sense of discipline of the soldier. I love these qualities in a man, not least because I have never been granted them. For indeed, as Eric Linklater says in *Private Angelo*, courage is a gift—*il dono di corragio*. But the Colonel has even more than these gifts. He has, like Mr. Chips, cultivated a whimsical scholarship that makes his company one of pure delight. Even when he gently rebukes you for some carelessness of speech—and in my role of Saul to his Gamaliel I have had many rebukes—there is always laughter in the clouds.

No petty thing could make the Colonel angry, but carelessness of speech does distress him. When he retired and came to live in the Australian countryside over 20 years ago, among others he sought out was the local rector, who said to him on parting: "Will you be at home next Thursday afternoon?" The Colonel replied "Yes." It so happened that on that Thursday afternoon there was a cocktail party some five miles away. Now the Colonel greatly enjoyed these parties. They involved a ride through the bush, the sight of pretty girls, the hearing of much laughter, and the banter between old friends. In fact, the Colonel liked them so much that he threatened one day to drink a cocktail—a threat he may yet carry out. However, he gave up all these delights to await the rector, who, on arrival, said: "I didn't expect to find you in I thought you would be at the party. Any day would have suited me." The Colonel had assumed that when the rector had asked "Will you be at home next Thursday afternoon?" he meant what he said, namely: "Are you willing to be at home next Thursday afternoon?" What the rector meant but did not say was: "Shall you be at home next Thursday afternoon?" meaning "Do you expect to be at home next Thursday afternoon?"

And so a pleasant afternoon was lost because the rector did not know the difference between "shall" and "will."

Two Perfect Squelches (5)

From *The Spreading Chestnut Tree*, by Bennet Finck, a delightful collection of "anecdotes mostly connected with clerical life":

(1) A certain bishop had a pronounced dislike of journalistic clergy. One of them pleaded the example of Dean Inge, who did not disdain journalism, although a pillar of the Church. "He isn't a pillar of the Church," said the prelate, sardonically, "he is only a *column* in the *Evening Standard.*"

(2) A theatrical stage hand was asked by a pompous actor:

"And what, my man, is your vocation?"

"I am Baptist," he answered.

"No, no, that's your belief. I want to know your vocation. For example, I am an actor."

"No, sir! That's your belief!" was the shattering retort.